



**A FOREST FLORA FOR THE PUNJAB WITH
HAZARA AND DELHI.**

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A
FOREST FLORA

FOR THE
PUNJAB



WITH
HAZARA AND DELHI

BY
R. N. PARKER
Deputy Conservator of Forests.



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INTRODUCTION.

THE area dealt with in this flora includes in addition to the Province of the Punjab, as at present constituted, the territory to the west of the Jumna attached to the Imperial Capital at Delhi and the Hazara District of the North-West Frontier Province. Both these areas belong geographically to the Punjab and were until recently included in the Province.

Though primarily intended for forest officers there is in India a large class interested in the vegetation and particularly in trees and shrubs. These persons wish to know the names of the trees and shrubs they constantly see in the course of their duties, in gardens, on roadsides or planted at railway stations, &c. I have often been asked to recommend a book which will enable a man, often with a good knowledge of botany, to identify the plants he sees commonly in gardens, and I have had to reply that there is no such book available. These garden plants are largely exotic species from all parts of the world, and an extensive library is necessary to be able to identify them. Apart from these members of the public to whom I hope this book may be of use, a knowledge of garden plants is of interest to many forest officers. During the year I worked at Dehra Dun as Forest Botanist I had a considerable number of exotic plants sent in for identification by forest officers. For this reason I have mentioned most of the exotic trees and shrubs grown in the Punjab, and as the mere mention of the name of a plant is useless to any one who does not know the plant, I have added the descriptions in full in the case of those commonly grown and more briefly for most of the remainder. These descriptions will be found in small type at the end of the family to which the plant belongs or at the end of the genus if in that genus there are also indigenous representatives. To make this portion of the work complete is of course impossible since plants are introduced and distributed for a time and then may be allowed to die out and fresh plants are constantly being imported, but at the present time the number of species grown in gardens in the Province is comparatively small and the exotic garden flora does not change rapidly. A large proportion of the exotic plants grown are plants of economic importance, and many have been introduced repeatedly at considerable trouble by persons who were unaware that they already existed in cultivation, so that an account of such plants with notes on their growth in the Punjab may be found useful. Although the inclusion of these garden plants has added to the bulk of the book it does not increase the difficulty of identifying a wild plant, since exotics have been omitted from all the keys and are only taken into consideration in the Synopsis of the Families.

I have included all trees, shrubs and woody climbers found wild or naturalized in the area dealt with and I have also included the undershrubs. The distinction between trees and shrubs is notoriously difficult to define, but the distinction between an undershrub and a herb is even more so. In many cases it is merely a question of locality and probably most undershrubs become under favorable conditions almost shrubs and under unfavorable conditions remain herbaceous. It may be objected that undershrubs should not be included in a forest flora, but this I hold depends on the province for which the flora is prepared. In a province like the Punjab where the flora is relatively poor it should not be difficult for a forest officer to know most of the undershrubs as well as the more woody plants, and many of them are of considerable importance as fodder plants for camels. With a very few exceptions, *e.g.*, *Dioscorea*, I have made no mention whatever of herbs, only a few of economic importance or particularly conspicuous or likely to be confused with woody species being briefly mentioned. Several plants such as the mango, *Robinia*, white siris and others, I have included though they are not wild nor properly naturalized in the Punjab. They are however so commonly grown in certain places that they are frequently taken to be indigenous, and it is less confusing to treat them as such, than it would be to include them with the obviously exotic species.

For those interested in the progress of forest botany I would make a few suggestions as to the manner in which they can assist. The writer of a flora has to depend for his information almost entirely on dried herbarium specimens, and there are many points which cannot be ascertained from ordinary specimens, such as for instance the dimensions attained by a tree or shrub, the color of the flowers, &c. For these he has to depend on notes made in the field, such notes if sent in with a specimen of the plant to which they refer are in most herbaria attached to the sheet on which the plant is mounted and remain as a permanent record. In addition to this, species not at present known to occur in the Punjab or found growing in districts in which they have not been recorded should be collected and sent to Dehra Dun where they will be carefully preserved for future reference. Many species have been assigned to the Punjab by various authorities, but no specimens are available to prove their occurrence. Most of these I have accepted although I have seen no specimens in the herbaria at Dehra Dun, Calcutta Botanic Gardens and Indian Museum.

List of species included in the Punjab Forest Flora although I have seen no specimens from the Punjab, with reasons for their inclusion.

Miliusa velutina.—E. M. Coventry, mss. J. H. Lace, Temp. Working Plan, Kalesar, 1892, p. 4.

Tinospora cordifolia.—Brandis, Ind. Trees, p. 700.

- Cochlospermum Gossypium*.—Brandis, For. Fl., p. 17.
- Tamarix salina*.—Thiselton Dyer in Hook. f. Fl. Brit. Ind. I, p. 248.
- Eurya acuminata*.—E. M. Coventry, mss.
- Sida acuta*.—Fl. Brit. Ind., vol. I, p. 323.
- Hibiscus hirtus*.—Duthie, Fl. Upper Gang. Plain, p. 89.
- Thespesia macrophylla*.—E. M. Coventry, mss.
- Pterospermum acerifolium*.—E. M. Coventry, mss.
- Grewia sclerophylla*.—E. M. Coventry, mss.
- Triumfetta rhomboidea*.—Fl. Brit. Ind., vol. I, p. 395.
- Glycosmis pentaphylla*.—Fl. Brit. Ind., vol. I, p. 500.
- Garuga pinnata*.—J. L. Stewart, Punjab Plants, p. 45.
- Commiphora Mukul*.—Gurgaon Dist. Gaz., 1883-84, p. 17, and Brandis, Ind. Trees, p. 703.
- Rhamnus* sp. No. 6.—Brandis For. Fl., p. 93.
- Gouania leptostachya*.—J. H. Lace, in Hart, Kangra Working Plan, p. cv.
- Leea alata*.—Duthie, Fl. Upper Gang. Plain, p. 175.
- Semecarpus Anacardium*.—Fl. Brit. Ind., vol. II, p. 31.
- Tephrosia villosa*.—See p. 134.
- Caragana decorticans*.—Prain, Journ. As. Soc. Beng. LXVI, (ii), 2, p. 372.
- Uraria lagopus*.—Duthie, Fl. Upper Gang. Plain, p. 274.
- Desmodium latifolium*.—J. H. Lace, in Hart, Kangra Working Plan, p. cvi.
- Pyrus Aucuparia*.—Fl. Brit. Ind., vol. II, p. 375.
- Ribes nigrum*.—Fl. Brit. Ind., vol. II, p. 411.
- Combretum decandrum*.—Duthie, Fl. Upper Gang. Plain, p. 338.
- Pluchea Wallichiana*.—Fl. Brit. Ind., vol. III, p. 272.
- Mæsa indica*.—J. H. Lace, in Hart, Kangra Working Plan, p. cviii.
- Rauwolfia serpentina*.—Fl. Brit. Ind., vol. III, page 632.

Cordia Macleodii.—J. H. Lace, in Hart, Kangra Working Plan, p. cix, and J. L. Pigot, Murree and Kahuta Working Plan, p. lxxxiii

Breweria latifolia.—Fl. Brit. Ind., vol. IV, p. 224

Premna herbacea.—Brandis, Ind. Trees, p. 511.

Clerodendron infortunatum.—E. M. Coventry, mss.

Haloxylon multiflorum.—Fl. Brit. Ind., vol. V, p. 16.

Anabasis phyllophora.—Fl. Brit. Ind., vol. V, p. 19.

Daphne retusa.—See p. 432.

Trema orientalis.—J. H. Lace, in Hart, Kangra Working Plan, p. cx.

Pouzolzia viminea.—Collett, Fl. Siml., p. 467

Salix Lindleyana.—See p. 506-07, also J. H. Lace, Pangri Working Plan, 1901, p. 60.

Phoenix humilis.—See p. 524.

Phoenix acaulis.—J. L. Stewart, Punjab Plants, p. 243.

Two courses are open to the writer of a flora—he may either aim at making his descriptions as short and concise as possible or he may endeavor to describe the plants in full detail. The first course has many obvious advantages, but if only a few characters are selected to distinguish between two species of a genus it will frequently be found that a plant is not in the proper stage and hence cannot be identified whereas had a detailed description of the two been given it could in many cases be determined on other characters. Forest officers frequently are only able to visit certain localities at certain times of the year and consequently it often happens that they know a plant well in fruit but have not seen it in flower and *vice versa*. For the last two years I have been using most of the Indian Floras and I have found detailed descriptions most useful especially those given by Dr. Cooke in his Flora of the Presidency of Bombay. I have therefore decided in favor of detailed descriptions, and I particularly wish to acknowledge the use I have made of Cooke's Flora which has been constantly referred to when describing plants which he also deals with and in a few cases where the specimens at Dehra Dun have been very scanty I have had to rely mainly on the excellent descriptions given by Cooke. I have also freely consulted the following works amongst many others:—Collett, Flora Simlensis; Brandis, Forest Flora and Indian Trees; Duthie, Flora of Upper Gangetic Plain, volumes 1 and 2; Schneider, Illustriertes Handbuch der Laubholzkunde; Kanjilal, Forest Flora; and of course Hooker's Flora of British India.

I would warn anyone using the vernacular names as a "short cut" to identification of the serious risk of error he runs; if they are so used it is essential to compare the description with the plant in question. I contemplated omitting the vernacular names altogether as my own experience with them has been that they are almost valueless except in the cases of well-known plants. I have frequently tried to identify a plant which I could not find in flower or fruit, from its vernacular name using the extensive lists of vernacular names to be found in E. M. Coventry's Catalogue of Trees and Shrubs of the Punjab, J. L. Stewart's Punjab Plants and J. S. Gamble's Manual of Indian Timbers, but I cannot remember having been once successful though the plants I wished to identify were by no means rare. I have found numerous instances of Forest Officers quoting a botanical name obtained from a list giving the botanical equivalents of vernacular names, which had they looked at the description of the plant they must have seen was wrong. Having obtained the probable identification of a plant from incomplete material the vernacular name may be found to confirm the identification and for this purpose they are useful but more cannot be expected from the majority of vernacular names. Very many names will be found with a number of forms of spelling though obviously the same name such as *kamila*, *kámbla*, *kambal*, *kámab*, *kamela*, all quoted by E. M. Coventry for *Mallotus philippinensis*: in such cases I have usually quoted one or two forms of the name only to avoid confusion. A little experience will soon show the sort of variations the Punjab villager makes in such words and the omission of what amounts to petty differences of pronunciation will probably cause less confusion than the indefinite multiplication of the names. Very many vernacular names I have omitted because they are used for a large number of plants, thus *batti* is always given in Rawalpindi as the vernacular name of *Xylosma longifolium* and would be an excellent vernacular name were it not also used for at least half-a-dozen other species; in fact it is a general name for any evergreen tree or shrub which has no special name of its own. These remarks are intended to show why I have been unable to give vernacular names for many common plants and have also been unable to use many vernacular names which have been supplied to me by Forest Officers. To sort out the really useful vernacular names from the mass which has been collected is a matter of great difficulty and I cannot guarantee that the names I have quoted are reliable and in any case a villager when asked the name of a tree he does not know will usually give the first name that comes into his head so that even the best names will often appear unreliable.

In describing the armament of plants I have used the word *thorn* for metamorphosed branches, *spine* for metamorphosed leaves, bracts and stipules, and *prickle* for a superficial out-growth from the bark. This is by no means universal or even usual in botani-

cal works, but has made it unnecessary to give any remarks as to the origin of the thorns, &c., found on the plants described. It is not possible to carry the distinction very far since branches which end in a thorn or tend to be thorn-like can only be called spinescent and the specific name *spinosa* has been given to plants which are thorny, spiny or prickly indiscriminately. These remarks will however explain why I have sometimes used the term thorn as opposed to spine or spine as something distinct from prickle.

My thanks are due to Mr. R. S. Hole, Forest Botanist, Dehra Dun, for facilities for working at Dehra Dun where almost all this work has been prepared and for the free use of the library and herbarium. Also to Major Gage, Director of the Royal Botanic Gardens, Calcutta, for his generous hospitality and facilities for working at the herbarium in Calcutta. To Dr. Carter, Economic Botanist, for permission to inspect the herbarium at the Indian Museum. To Herr C. K. Schneider, Vienna, for kindly checking the identifications of *Berberis* in my own collection, and to D. Griffiths of the Bureau of Plant Industry, Washington, United States of America, for the identification of *Opuntia stricta* and for sending me full-sized photographs of it and of its closest ally.

Most of the Punjab Forest Officers have contributed to this work mainly in furnishing vernacular names, and from Mr. Jerram and Bhai Kartar Singh I have received good collections of specimens which have been of considerable use. Mr. E. M. Coventry, formerly of the Punjab Forest Department, on his retiring from the service handed on to me some manuscript notes which I have been able to use.

LAHORE :

R. N. PARKER.

April 1915.

General Account of the Flora of the Punjab.

THE Punjab may conveniently be divided into the following areas, each of which has a characteristic type of vegetation :—

(i) The Plains ; (ii) The Salt Range ; (iii) The Sub-Himalayan tract ; and (iv) The Himalaya.

The Plains is by far the largest of these divisions but is the poorest in its vegetation owing to the dryness of the climate. The boundary on the East, South and West is the political boundary of the Province. On the North this division is bounded west of the Jhelum by the Salt Range and east of the Jhelum by the Sub-Himalayan tract. Portions of the Gurdaspur, Hoshiarpur and Ambala Districts have a rainfall approaching 40 inches, and although geographically part of the plains have a Sub-Himalayan flora. The forests in the plains where they have not been destroyed by the increase of cultivation consist of three trees :—*Prosopis spici-gera*, *Salvadora oleoides* and *Capparis aphylla*. The height varies from 15 to 30 feet and the trees tend to occur in clumps leaving bare ground between the clumps. It is usually possible without much difficulty to drive a trap through these forests or *rakhs* as they are called, as the trees are seldom close enough to prevent the passage of a trap. Except for old river banks the ground is to the eye dead level and the aspect of the vegetation the same mile after mile, so as there are no landmarks it is necessary to guide oneself by the sun. Except in the case of *Salvadora* which regenerates fairly well in dense shady clumps, young growth is mainly due to root suckers which *Prosopis*, *Capparis* and most of the *rakh* shrubs produce. Seedling regeneration of *Prosopis spici-gera* is only found near rivers and in depressions where water collects during the monsoon. Climbers are relatively numerous, and it is not uncommon to find 3 or 4 different species of climbers growing over a big *Salvadora* or *Capparis*.

The increase of irrigation has been almost entirely at the expense of the *rakhs* and the time is fast approaching when none of them will be left in their original condition as those which have not been thrown open to cultivation are worked for firewood. In the case of small *rakhs* surrounded by cultivation it is not uncommon to find trees such as *Acacia arabica*, *Acacia modesta*, *Morus alba* and other plants not normally found in the *rakhs* establishing themselves, due probably to an increase in the relative humidity, rise of the subsoil water level and moderation of the hot wind brought about by irrigation and cultivation. Outside the *rakhs* in irrigated tracts the typical *rakh* plants very soon disappear and are replaced by cultivated plants such as *Acacia arabica*, *Albizia Lebbeck*, *Zizyplus Jujuba*, etc. In the moister parts of the plains Sub-Himalayan plants are extending their range and some of them will probably in time extend all over the irrigated portion of the plains.

The influence of soil is more marked in the plains than in the other divisions. Tracts impregnated with salts locally known as *kallar* are widely distributed. The salts are usually chloride, sulphate and carbonate of sodium in varying proportions. These saline patches are usually irregular in outline, but sometimes occur in long strips. As a rule in the *rakhs* in the dry season the saline patches are quite bare, the surface having a peculiar polished appearance. If broken up by ploughing or if a mound of earth or a brick is placed on the surface a white incrustation of salt results owing to the raised surface causing a local increase in evaporation, but as a rule they can only be recognised by the absence of vegetation and the polished appearance of the surface. The cause of the accumulation of salts near the surface is that for some reason the amount of water which evaporates from the surface is greater than the amount of rain which falls on the surface and percolates down into the sub-soil water. Sometimes percolation downwards is prevented by a hard bed of clay, at other times by a layer of argillaceous concretionary nodular limestone (*kankar*), but a layer of *kankar* beneath the surface does not always give rise to *kallar*. Apart from the directly injurious effects of an abnormally large proportion of salts in the soil, the presence of the salts makes the soil very impervious to water so that in years of good rainfall patches of *kallar* are superficially waterlogged. Rain water may lie on the surface for days until it is evaporated away and yet during this time have only sunk a few inches into the soil. During a favorable monsoon *kallar* patches usually get covered with a grass—*Sporobolus arabicus*, Boiss. vern. *lundakh*. This grass is usually found growing pure on the worst *kallar* for a brief period after heavy rain. Very soon after the rain the *lundakh* dries up and the patches soon resume their bare polished aspect especially if exposed to grazing. *Lundakh* growing pure is a sure sign of soil heavily impregnated with *kallar*. If the soil is being improved by irrigation, closure to grazing and planting up the good soil around the saline patch, other grasses appear and the *lundakh* is soon driven out, as it can only hold its own in places where its competitors are kept back by an excess of salt. *Salsola foetida* and *Suaeda fruticosa* are specially adapted for saline situations and wherever they are common it is safe to assume that the soil is saline. Trees which will stand drought and water-logging usually do better than others on saline soils, for instance *Acacia arabica*, *Tamarix articulata* and *Butea frondosa* will stand more salt in the soil than most other trees especially if they are assisted by irrigation when young.

Sand is found in the Sind-Sagar Doab as far north as the Salt Range and in the districts and Native States to the north of the Rajputana desert and sandy soils have certain plants which avoid the less porous soil of the typical *rakhs* and they usually stop abruptly when the sand stops. Examples of these plants are *Crotalaria Burhia*, *Acacia Jacquemontii*, *Leptadenia Spartium*,

Sericostoma pauciflorum and *Calligonum polygonoides*. Some of these are also found on well drained soils which are not sandy as they do not demand sand but good drainage. Sandy soil is also found along the main rivers, but here the abundance of moisture has a greater effect than the sand. Along the rivers *Tamarix dioica* is the commonest woody plant with in places *Populus euphratica*. *Acacia Farnesiana* is naturalized along most of the rivers and *Dalbergia Sissoo* is also common in places either planted or self-sown from planted trees. Many of the Sub-Himalayan plants may be found extending out into the plains along the main rivers. *Wendlandia exserta*, for example, has been found as far from the hills as Jhang and it occurs on the Ravi near Lahore.

In the south-east of the Punjab in Rohtak, Hissar, Patiala State and Gurgaon there are a few isolated rocky hills the last outliers of the Aravalli Hills of Rajputana. The Ridge at Delhi is the best known example. The natural growth on these hills has been mostly destroyed but in the Khetri Jagir of Jaipur State only 20 miles from the Punjab border a portion has been preserved which shows that the natural covering of these hills consisted of *Anogeissus pendula* and *Acacia Senegal*. The following plants occur on the rocky hills in the north of Jaipur State and most of them have been collected in similar places in the Punjab :— *Capparis sepiaria*, *Melbania futteyporensis*, *Grewia populifolia*, *salvifolia* and *flavescens*, *Boswellia serrata*, *Commiphora Mukul*, *Rhus mysorensis*, *Bauhinia racemosa*, *Dichrostachys cinerea*, *Mimosa hamata*, *Vogelia indica*, *Wrightia tinctoria*, *Cordia Rothii*, *Euphorbia Nivulia* and *Flueggea Leucopyrus*. With few exceptions the plants of the rocky hills are not found on the level ground between the hills. The flora of these hills resembles that of the Salt Range rather than that of the central Punjab plains.

The Salt Range division includes the Kala Chitta hills, the foot hills of the Himalaya west of the Jhelum and the elevated plain between them and the Salt Range proper. The flora resembles that of the plains in some respects and that of the Sub-Himalayan tract in others. The foot hills of the Himalaya to the west of Jhelum are a continuation of the Sub-Himalayan tract but owing to a smaller rainfall at the lower elevations the flora resembles that of the Salt Range except in moist ravines where a typical Sub-Himalayan flora is found. The Salt Range has several plants which extend into India from the west but do not cross the Jhelum such as *Periploca aphylla* and *hydaspidis*, *Rhazya stricta*, *Monothea buxifolia*, *Diospyros Lotus*, *Zizyphus sativa*, *Buxus papillosa* and *Nannorhops Ritchieana*. The forests on the Salt Range and Kala Chitta hills consist principally of *Olea cuspidata* and *Acacia modesta* and these species are dominant in the foot hills of the Himalaya west of the Jhelum. They

extend also to the east of the Jhelum but there no longer form the principal trees. Similarly *Dodonaea viscosa* is the most abundant shrub on low hills west of the Jhelum but to the east it rapidly loses its importance. In the body of the flora I have used the term Sub-Himalayan tract in its geographical sense to mean the foot hills as far west as the Indus and the Salt Range similarly means the actual Salt Range hills and not the neighboring areas which resemble it in their flora.

The Salt Range type of forest on the foot hills is usually called scrub forest and it ascends to about 3,000 feet. Above this is a belt of chil forest differing from that to the east of the Jhelum only in having less undergrowth than is usually found in the moister part of the chil zone. The relationship between the flora of the Salt Range and the Aravalli Hills is shown by such plants as *Melhania futteyporensis*, *Grewia salvifolia*, *Ehretia laevis*, &c.

The Sub-Himalayan tract extends along the foot of the Himalaya east of the Jhelum and includes its outer slopes to between 5,000 and 6,000 feet in the outer hills. It includes the whole of the Siwalik Hills and some of the moister parts of the plains where the rainfall approaches 40 inches. The Sub-Himalayan vegetation extends well into the Himalaya up the valleys of the main rivers and also extends to the Indus in moist ravines. The chil zone, which west of the Jhelum connects the Salt Range type of vegetation found below 3,000 feet with the Himalayan type which starts at about 5,500 feet, belongs to this area. The Sub-Himalayan area is botanically the richest and the flora is subtropical. In the east the flora is almost identical with that of the Dehra Dun but as one travels west the number of species decreases and very many plants instead of being common become scarce. As the Himalaya run approximately north-west in the Punjab the upper limit of the Sub-Himalayan flora drops from east to west. The upper boundary is not a sharp one as it is modified by aspect, gradient and rainfall as well as by distance from the plains. A southern aspect at 5,000 feet in the outer hills would have a Sub-Himalayan flora but in the inner hills a similar locality would have a Himalayan flora. These remarks which are made for the Sub-Himalayan flora as a whole apply to the species individually. A plant which extends to 4,000 feet in Hazara on southern aspects would be found up to 5,000 feet at least, on similar aspects in the Simla Hills.

The forests of the Sub-Himalayan area may be divided into three types, scrub, bamboo, and chil. The scrub forests contain a great number of trees and shrubs, none of which are of any value except for local use. Although they are composed largely of trees which under favorable conditions reach a large size and yield valuable timbers they are almost always on the worst soil, all the better soil being cultivated, so that the trees are not big enough for timber ex-

cent in rare instances and the forests are impossible to work except for fuel and local demand. Thus although trees such as *Shorea robusta*, *Terminalia tomentosa*, *Anogeissus latifolia* and *Ougeinia dalbergioides* are common in some of the scrub forests they are of no importance and do not contribute 1 per cent. of the forest revenue of the Province. The bamboo forests differ in no respect from the scrub forests except that they contain bamboo—*Dendrocalamus strictus*. At about 3,000 feet the chil forests commence, and although most of the species found in the scrub forests persist in the undergrowth and in moist ravines, the typical chil forests contain very little tree growth other than chil. In parts of Kangra chil and scrub are found mixed but in such cases the forests are scrub forests with a few chil scattered in them and consequently efforts to increase the proportion of chil in them have not been successful. These forests have a rainfall of about 60—70 inches which is more than the chil likes at low elevations. Moreover they occur on deeper soil than is usually found in forests in the Sub-Himalayan tract and consequently the chil is unable to suppress the scrub. Near Shahpur in the Kangra District there is a large patch of oaks mixed with *Albizzia stipulata* occurring in the chil zone. The soil is deep, the aspect cool and the rainfall is about 80 inches and consequently the ground is not occupied by chil. Close by on steeper rocky ground the forests are nearly pure chil. The chil forests extend to about 5,000 or 6,000 feet, higher on southern aspects and steep rocky slopes than on northern aspects and gentler slopes with better soil. At their upper limit they pass gradually into the temperate Himalayan forests.

Soil appears to have little influence on the vegetation in the Sub-Himalayan tract. Good soil tends to favor scrub forest at the expense of chil and has a marked effect on the luxuriances of the growth. Limestone appears to have no direct effect due to the lime but being dry and shallow favors certain plants which however are also found on shallow rocky ground where the rock is not limestone. Drainage on the other hand is important and most of the Sub-Himalayan plants require good drainage. Level ground in the Sub-Himalayan tract is almost always cultivated but occasionally small areas of old cultivation have been taken into the forests. Efforts to stock old cultivation with chil or bamboo have frequently been unsuccessful probably owing to insufficient drainage during the monsoon as both chil and bamboo avoid level ground.

The Himalayan flora is found from the upper limit of the Sub-Himalayan zone to the limit of tree growth. The limit of tree growth is usually between 11,000 and 12,000 feet. It is naturally higher on southern than on northern slopes and higher on the outer than on the inner ranges. It is also higher on steep than on gentle slopes due partly to a steep southern aspect being warmer than a gentle slope at the same elevation and aspect,

partly to the growing season being shorter on gentle slopes owing to accumulations of snow and partly to grazing which prevents the reproduction of trees on almost all the gentle slopes at the upper limit of forest growth. For these reasons it is usual to find junipers and birch extending on steep rocky ground several hundred feet higher than the forest.

The forests above the limit of chil usually consist of white oak and blue pine. At greater elevations the deodar and holly oak appear, then spruce, silver fir and finally brown oak. Each of these trees except the blue pine has a fairly well marked zone but there is a considerable amount of overlapping and one or other frequently does not occur at the elevation it usually occupies. Aspect and rainfall have a marked effect on the tree growth and the oaks and conifers are usually mixed with deciduous broad-leaved trees of many species. It is usual to find the growth on a ridge differing on the northern and southern aspects: for instance the southern aspect may be covered with blue pine or brown oak and the northern with spruce and silver fir or the southern aspect may be covered with white oak and the northern with deciduous broad-leaved trees. A heavy rainfall favors the deciduous broad-leaved trees at the expense of the oaks and conifers and where the rainfall is heavy it is usual to find the conifers tending to take the ridges and the deciduous broad-leaved trees the ravines. Another cause of overlapping of species which have a well marked zone is due to all trees tending to ascend beyond their normal limit on warm rocky slopes and to descend below it in moist ravines. For these reasons it is impossible to base a classification of the forests of the Himalaya on elevation or to give an exact upper and lower limit to the zone of any tree.

In the Himalaya there are certain dry inner valleys to which the monsoon does not penetrate such as Kagan drained by the Kunhar river in Hazara, Pangi on the upper Chenab and Kuna-war on the Sutlej. As one ascends a river such as the Sutlej, the rainfall tends to decrease as the moisture brought by the monsoon winds is deposited on each ridge in succession till a point is reached beyond which the monsoon does not penetrate. This point is usually well marked by an abrupt change in the vegetation. Most of the trees and shrubs of the outer Himalaya do not extend to the inner dry valleys, or if they do so, are confined to moist situations. On the other hand certain plants which are rarely if ever found in the outer hills become common such as *Acer pentapomicum*, *Fraxinus xanthoxyloides*, *Quercus Ilex*, *Pinus Gerardiana* and *Juniperus macropoda*. Certain shrubs such as *Plectranthus rugosus* and particularly *Artemisia maritima* tend to replace grass (*vide* pages 292—293). In Lahoul and Spiti where these conditions are still more marked and precipitation is practically confined to snow in winter, the flora is still more specialized and resembles that of the steppes of Central Asia and Tibet.

GLOSSARY OF BOTANIC TERMS.

The following list is based mainly on the Glossary compiled by R. L. Heinig published by the Superintendent, Government Printing, Calcutta, 1899. The meanings of common specific names have been included :—

A.

- Abortive**, imperfectly developed.
Acaulis, without a stem.
Accrescent, said of parts of the calyx or corolla that persist and increase in size after flowering.
Aculeate, armed with prickles.
Acuminate, tapering to an **acumen** or sharp point.
Adelphous, a term used in compounds with a numeral, *e.g.*, stamens monadelphous, meaning that the stamens are united into one bundle or tube.
Adherent, said of dissimilar parts when united but separable without laceration.
Adnate, said of the union of dissimilar parts.
Adpressed, lying close against throughout the whole length as hairs lying along a stem or against the surface of a leaf.
Adventitious, said of organs arising in an unusual position.
Alatus, winged.
Albescens, whitish or hoary.
Albuminous, said of seeds having albumen or nutritive substance often found surrounding the embryo.
Alternate, said of leaves placed singly on the stem, one at each node.
Amplexicaul, clasping the stem.
Anastomose, to join up like the fine veins in a leaf, so as to form a net.
Anatropous, said of an ovule having the micropyle next the hilum and the part where the seed coats unite with the nucleus at the apex.
Androgynophore, a stalk or stipe elevating both the stamens and the pistil of a flower.
Androgynous, said of an inflorescence which bears both male and female flowers.
Anthelmintic, a remedy for worms in the intestines.
Antheriferous, bearing anthers.
Anterior, said of the portion of an axillary flower that faces outwards from the axis of inflorescence.

A—concluded.

- Aphyllous**, without leaves.
Apiculate, having an apiculus or short-pointed tip.
Apocarpous, having the carpels separate from each other.
Arborescent, tree like in size or appearance.
Arcuate, curved like a bow.
Areolate, divided up into or marked with areoles or small spaces clearly outlined.
Argento-, silvery, shining greyish white.
Arenarius, growing in sandy places.
Aril, arillus, an accessory seed-covering produced after fertilisation and arising from the placenta or funicle.
Aristate, bearing an awn or bristle.
Armed, having spines, thorns or prickles.
Articulated, jointed.
Ascending, directed obliquely upwards.
Asexual, having neither male nor female organs.
Asper, rough.
Atro-, in compounds, blackish.
Attenuate, narrow and gradually tapering.
Auricle, an appendage like the lobe of the ear.
Auriculate, having auricles.
Australis, southern.
Axil, the upper angle between a leaf and its stem or twig.
Axile, said of placentas attached to the inner angles of the cells of a compound ovary.
Axillary, in or relating to an axil.

B.

- Baccate**, berry-like; pulpy throughout.
Bacillaris, used for making walking sticks.
Barbatus, bearded.
Basal, attached to or arising from the base.
Basifixed, said of an anther with connate cells attached at the lower end to the top of the filament.
Bi- (in compounds) two, twice, doubly.

B—concluded.

Bilabiate, two-lipped, a term applied to some gamopetalous flowers, the upper lip usually of two united petals, the lower of three.

Bisexual, said of flowers which have stamens and pistil in the same flower.

Bulb, a leaf-bud usually underground, composed of a short fleshy axis enclosed in fleshy scales, *e. g.* onion.

Bulbil, a small bulb usually applied to those which arise in the axils of the leaves of **Dioscorea** or on the inflorescence of **Agave**.

C

Caducous, falling off early.

Cæruleus, dark blue.

Cæsius, bluish-grey.

Callus, a hard projection:

Calyceine, pertaining to or resembling the calyx.

Calyculus, a minute whorl of bracts below the calyx resembling an additional calyx.

Calyptra, a cap or hood; **Calyptrate**, hooded; **Calyptriform**, shaped like a cap.

Campanulate, bell-shaped.

Campestris, growing in fields.

Candidus, pure white.

Canescent, covered with very short pubescence giving the surface a greyish white hue.

Capitate, head-shaped or collected into a head; *dim.* **Capitellate**.

Capreolate, bearing tendrils.

Capsular, like a capsule or dry dehiscent seed vessel composed of more than one carpel.

Carinatus, keeled.

Carnosus, fleshy.

Carpophyll, a leaf which functions as a carpel.

Caryopsis, a one-seeded fruit with the pericarp adherent to the seed.

Catkin, a deciduous spike of unisexual flowers.

Caudate, tailed.

Cauline, pertaining to the stem.

Cernuous, nodding.

Cilia, thick marginal hairs forming a fringe; **Ciliate**, having cilia; *dim.* **Ciliolate**.

Cinerascens, becoming ash-colored.

Cinereous, ash-colored.

Circinate, coiled inward from the tip like the young frond of a fern.

C—continued.

Circumsciss, dividing or opening circularly or transversely, as a capsule opening by a lid.

Cirrhous, a tendril; **Cirrhose**, bearing tendrils.

Cladode, a flattened branch which assumes the form and function of a leaf.

Clavate, club-shaped.

Claw, the narrowed base of certain petals.

Coherent, said of similar parts when united but separable without laceration.

Collateral, placed side by side.

Coma, a tuft of soft hairs, especially those on a seed.

Comose, furnished with a tuft of long soft hairs.

Concinnus, neat or elegant.

Conduplicate, folded together lengthwise.

Connate, said of the union of similar parts.

Connective, that portion of the stamen which unites the two lobes of the anther.

Conniving or **connivent**, having the parts or organs arching over or converging at the apex.

Contorted, twisted in one direction upon itself; with one margin of each leaf within and the other margin without the coil.

Convolute, contorted (only in aestivation).

Cordate, heart-shaped.

Coriaceous, leathery, thick and tough.

Corm, a bulb-like fleshy stem or base of a stem.

Cornute, horned.

Corolline, pertaining to or resembling the corolla.

Corona, a whorl of outgrowths from the stamens or corolla.

Corymb, an inflorescence which has the lower flower stalks longer than the upper, so as to bring all the flowers to about the same level; **Corymbose**, in corymbs or having the character of corymbs.

Costate, ribbed.

Crenate, with rounded teeth; *dim.* **Crenulate**.

Crenatures, the minute notches of a crenate leaf.

C—concluded.

Crimped, corrugate or irregularly wrinkled.

Cristate, crested.

Crustaceous, hard and brittle.

Culm, the characteristic hollow jointed stem of grasses.

Cuneate, wedge-shaped.

Cupular, cup-shaped.

Cuspidate, tapering to a cusp or long rigid point.

Cyathiform, wine-cup-shaped.

Cyme, an inflorescence in which the main axis and all the lateral axes are each terminated by a flower and the flowering proceeds outwards and downwards; **Cymose**, in cymes or having the character of cymes.

Cystolith, a cell containing crystalline concretions of calcium carbonate.

D.

Dealbus, whitened with powder or minute pubescence.

Declinate, bent to one side or downward.

Decomound, said of a compound leaf the divisions and sub-divisions of which are also compound.

Decurrent, applied to leaves when the blade is produced down the stem as a wing or ridge.

Decussate, said of leaves arranged on the stem in pairs, each pair being at right angles to the pairs above and below it.

Definite, limited as to number, shape or character. Applied to stamens when they are not more than about 20.

Dehisce, to open at maturity so as to discharge the contents; *n.* **Dehiscence**.

Deltoid, triangular in outline.

Dentate, toothed, with the margin cut into triangular teeth directed outwards, not forward or backward; *dim.* **Denticulate**.

Di, **dis** (prefix), two, twice, double.

Dichotomous, forked in pairs.

Diclinous, having the stamens in one flower and the pistil in another.

Didymous, slightly two-lobed or found in pairs.

Didynamous, having two long and two short stamens.

Diffuse, widely or loosely spreading.

D—concluded.

Digitate, applied to a compound leaf when the leaflets are borne on the apex of the petiole.

Dimorphous, occurring in two forms. Usually applied to bisexual flowers, some having long stamens and short style, others short stamens and long style.

Dioecious, unisexual with the male and female flowers on separate plants.

Disarticulate, to break off at a joint or break up into pieces at joints.

Discoid, disk-like, flat and circular.

Disk, a development of the receptacle of a flower as a cushion, cup, ring or glands; the central portion of the flower heads in *Compositae*.

Dissemination, the partition of an ovary consisting of the contiguous faces of two carpels, when otherwise formed as by an outgrowth from the dorsal suture or from the placenta, it is said to be false or spurious.

Distal, furthest from the base.

Distichous, arranged in two opposite rows, both rows being in the same plane.

Divaricate, spreading widely apart.

Dorsal, relating to or attached to the back.

Dorsifixed, said of an anther attached to the top of the filament by a part, not the whole of the back.

Drupaceous, resembling or relating to a drupe.

Druplet, a diminutive drupe.

Dulcis, agreeable to the sight or taste.

Dumose, bushy; *dumetorum* relating to thickets.

E.

E, **ex**, without, out of (as a prefix).

Eburneous, ivory-white.

Echinate, covered with sharp prickles or bristles, like a hedge-hog.

Eduilis, edible.

Elatus, lofty.

Emarginate, notched at the apex.

Emmenagogue, a medicine for promoting the menstrual flow.

Endocarp, the inner layer of the pericarp.

Epi, upon (as a prefix).

Epicarp, the outer layer of pericarp when composed of three layers, *viz.*, **epi-**, **mezo-** and **endocarp**.

E—concluded.

- Epigynous**, growing upon or inserted on the top of the ovary.
Epiphyte, a plant growing upon, but not nourished by, another plant.
Eriocarpus, with a woolly fruit.
Ectrophioate, having no strophiole or appendage at the hilum.
Exalbuminous, without albumen, the food material of the seed being stored in the embryo itself.
Excelsus, tall.
Exocarp, the outer layer of the pericarp when there are only two layers, *viz.*, exo- and endo-carp.
Extrorse, turned or opening outwards.

F.

- Falcate**, sickle-shaped.
Fascicle, a close or dense cluster.
Fastigate, applied to branches which are nearly parallel and point upward.
Farious, used in compounds with a numeral, *e.g.*, bifarious, in two opposite rows.
Ferous, (in compounds), bearing.
Ferruginous, the color of iron rust.
Fid, cut at the margin but not very deeply. Used in compounds, *e.g.*, palmatifid.
Filamentose, thread-like.
Filiform, thread-like.
Fimbriate, having a fringe or border of fine thread-like processes.
Fistular, hollow, tubular.
Flabellate, or **Flabelliform**, fan-shaped.
Flaccid, soft, wanting in stiffness.
Flavus, yellow; **Flavidus**, yellowish.
Flexuous, wavy, zig-zag.
Floribundus, bearing flowers in abundance.
Follicle, a fruit of a single carpel dehiscing by one suture only, usually the ventral.
Formosus, beautiful.
Fruticosus, shrubby.
Fugacious, falling off or fading very early.
Fulgid, shining.
Fulvous, tawny.
Funicle, the thread or stalk connecting the ovule or seed with the placenta.
Furcate, forked.
Fuscous, dark-colored, greyish-brown.
Fusiform, spindle-shaped, tapering at both ends and somewhat bulging at the centre.

G.

- Gamopetalous**, with united petals.
Geminate, in pairs.
Genitalia, the sexual organs, stamens and pistil.
Gibbous, having a pouch-like swelling on one side.
Glabrous, without hairs or down.
Glabrate, **Glabrescent**, becoming glabrous or nearly so.
Gland, a swelling or excrescence of the surface, dry or secreting oil or resin: an oil vesicle in the epidermis or in leaves, flowers or fruit: a lobe of the flower-disk.
Glaucous, bluish-grey or bluish-green; **Glaucouscent**, somewhat glaucous.
Globose, somewhat spherical.
Glochidia, barbed bristles.
Glomerate, compactly clustered.
Glume, one of the chaff-like bracts found in the flowers of grasses and sedges.
Glutinous, sticky.
Gracilis, slender.
Graveolens, with a strong somewhat unpleasant odor.
Gregarious, growing or tending to grow in groups of the same species.
Griseus, bluish-grey.
Guti, a term used in India for a kind of layer made by ringing a branch and covering the portion ringed with moist earth and moss until roots form.
Gynophore, an elongation of the receptacle forming a stipe to the pistil.

H.

- Hamate** or **Hamose**, with the end curved or hooked.
Hastate, spear-head-shaped.
Haustorium, a root-like sucker, the sucker at the end of a parasitic root.
Herbalist, one who studies plants mainly with reference to their medicinal properties.
Heterogamous, when male, female, bisexual and neuter florets or any two or three of these are borne in the same flower-head.
Hilum, the point of attachment of an ovule to the funicle; the scar left on the seed by its separation from the funicle.
Hirsute, covered with long and somewhat stiff hairs.
Hispid, covered with long stiff bristly hairs.

H—concluded.

- Homogamous**, with the florets of a flower-head alike in sex.
Hortensis, growing in gardens.
Humilis, low in stature.
Hyaline, colorless and transparent.
Hypocrateriform, salver-shaped ; said of a corolla with slender cylindric tube and flat horizontally expanded limb.
Hypogynous, inserted below the ovary.
Hypoleucus, applied to leaves with the lower surface white.

I.

- Imbricate**, overlapping.
Imparipinnate, pinnate with a terminal leaflet.
Incanus, grey or hoary.
Incised, cut sharply and irregularly ; **Inciso-serrate**, deeply serrate.
Incumbent, leaning upon.
Indefinite, too many to be readily counted.
Induplicate, with the margins folded inward.
Indurated, hardened.
Inermis, unarmed.
Inferior, situated below ; - **ovary**, one wholly adnate to the calyx-tube or nearly so.
Inflorescence, the arrangement of flowers on an axis ; the axis with all the flowers it bears.
Insignis, remarkable.
Inter- (prefix), between.
Interfoliar, said of a palm-spadix which flowers while the leaf in whose axil it is formed is still green.
Interpetiolar, between the petioles.
Intra- (prefix), within.
Intrapetiolar, within the petiole or between it and the stem.
Introrse, turned or opening inward.
Involucre, **involucrum**, a whorl of bracts surrounding several flowers ; **Involucrate**, having an involucre.
Involute, rolled inward.
Irregular flower, one in which the petals or perianth-segments are unequal in size or shape or inserted at unequal distances.
Isomerous, having an equal number of members.

J.

- Jugum**, a pair of leaflets.
Julaceous, catkin-like ; **Juliflora**, with catkin-like inflorescence.
Junceus, rush-like.

K.

- Keel** (in a papilionaceous flower), the two anterior petals which are usually more or less united.

L.

- Lacerate**, irregularly cleft as if torn.
Lacinate, irregularly cut into narrow segments, fringed with narrow lobes.
Lacunose, marked with minute pits or depressions.
Lævigata, smooth as if polished.
Lævis, smooth.
Lanate, woolly.
Lanceolate, shaped like a lance head ; narrowly ovate and tapering to both ends.
Lanuginose, woolly or cottony, finer than lanate.
Lasiocarpus, with pubescent fruit.
Latex, milky-juice.
Left (twisted to the —, overlapping to the —, twining to the left) from right to left as viewed from outside in front of the coil or plant or flower bud.
Legume, a pod. A fruit from a single carpel opening by both sutures when ripe.
Lepidote, covered with scurfy scales.
Leucophloea, having whitish bark.
Ligulate, strap-shaped.
Ligule, the strap-shaped ray florets in many *Compositæ* ; a scarious projection from the leaf-sheath of grasses at the junction of the blade ; an outgrowth from the inner face of certain petals.
Limb, the expanded portion of a gamo-petalous flower or the blade of a clawed petal or of a leaf.
Linear, several times longer than wide with nearly parallel edges.
Lineolate, marked with fine lines.
Lip, one of the two divisions of a bilabiate calyx or corolla.
Lobulate, having minute lobes.
Locellus, a secondary division of a cell ; **Locellate**, said of an ovary of one cell divided into two locelli or compartments.

L—concluded.

- Loculicidal**, a form of dehiscence of a ripe carpel, the split being down the dorsal suture, *i.e.*, into the cell and not between the cells.
Loculus, the cell of an ovary.
Lodicules, minute scales at the base of the ovary of grasses representing the perianth.
Lucidus, bright, clear, with a shining surface.

M.

- Macrophyllus**, having large leaves.
Mammillate, having granular teat-like prominences.
Marcescent, withering without falling off.
Melanophloia, having black bark.
Melanoxydon, having black wood.
Mesocarp, the middle layer of the pericarp.
Microphyllus, having small leaves.
Mollis, soft, tender, flexible.
Mon-, **mono-** (prefix), one, alone, single.
Moniliform, like a necklace, cylindric and contracted at intervals.
Monococious, having the stamens and pistil in separate flowers on the same plant.
Moschate, having the odor of musk.
Mucro, a short, straight, stiff, abrupt point; **Mucronate**, tipped with a mucro.
Muricate, rough with short sharp points.
Muticous, blunt.

N.

- Nalla**, a deep water-course, usually dry.
Nanus, dwarf.
Nemoralis, growing in groves.
Nitidus, shining.
Niveus, snowy white.
Nocturnus, flowering by night.
Nutans, nodding.

O.

- Ob-** (prefix), reversed or inverted; *e.g.*,
Obconic, shaped like an inverted cone.
Obdiplostemonous, having twice as many stamens as petals in two whorls, those of the outer whorl being inserted opposite the petals.
Odoratus, sweet-smelling

O—concluded.

- Officinalis**, used in medicine or procurable in shops.
Operculum, a lid.
Opposite, said of leaves found in pairs at the nodes one on either side of the stem.
Ovate, shaped like an egg in elevation with the broader part at the base.
Oxy- (prefix), sharp, sour.

P.

- Pachy-** (prefix), thick.
Palea, the inner glume of the flowers of grasses.
Palmate, having the ribs of the leaflobes or leaflets all meeting at the apex of the petiole, the segments like the extended fingers of a hand.
Palminerved, **Palmiveined**, having ribs divergent from the point of insertion of the leaf.
Panduriform, fiddle-shaped.
Panicle, a loose compound inflorescence with usually the main axis racemose, the secondary and tertiary axes racemose or not.
Papillose, having minute nipple-like projections.
Pappus, the ring of hairs or scales at the apex of the fruit in Compositae.
Parietal, said of placentas attached to the wall of the cells of a compound ovary.
Paripinnate, pinnate with an even number of leaflets, *i.e.* with no terminal one.
Partite, divided but not quite to the base.
Patent, widely spreading.
Patulus, standing open, somewhat spreading.
Paucifolius, having few leaves or leaflets.
Pectinate, with close narrow segments like the teeth of a comb.
Pedate, palmately divided with the lateral segments two-cleft.
Pedicel, the ultimate stalk supporting a single flower of an inflorescence;
Pedicellate, having a pedicel.
Peduncle, the stalk of a flower or of a cluster of flowers; **Pedunculate**, having a peduncle.
Pellucid, transparent or translucent.
Peltate, shield-shaped; said of a flat body, as a leaf, attached to the stalk by the lower surface and not by the margin or base.

P—continued.

- Penicellate**, bordered or tipped with brush-like hairs.
- Penninerved, Penniveined**, having the lateral nerves of the leaf running straight from the midrib to the margin.
- Penta-**, (in compounds) five.
- Pentamerous**, said of the flower when there are five members in each whorl.
- Perianth**, the floral envelopes, calyx or corolla or both; a term mainly used when there is little or no difference in size and appearance between the sepals and petals.
- Pericarp**, the ripened ovary with its constituent parts, consisting sometimes of two layers (exocarp and endocarp) or of three (epi-, meso- and endo-carp).
- Perigynous**, inserted around and away from the ovary.
- Petaloid**, resembling petals.
- Petiole**, the stalk of a leaf; adj. **Petioleate**: **Petiolule**, the stalk of a leaflet; adj. **Petiolulate**.
- Phœniceus**, scarlet.
- Phyllocladium**, a branch modified to resemble a leaf in form and function.
- Phyllodium**, a petiole having the form and function of a leaf, the blade being abortive.
- Pictus**, marked with color as though painted.
- Pilose**, thinly hairy with long soft simple hairs.
- Pinna**, the primary division of a compound leaf when itself divided into leaflets.
- Pinnate**, said of a compound leaf with leaflets or pinnae arranged on either side of the rachis.
- Pinnule**, the secondary division of a compound leaf when itself divided into leaflets.
- Pisiform**, pea-shaped.
- Pistillode**, the abortive ovary in male flowers.
- Placenta**, the place or process in the ovary on which the ovules are borne.
- Platyphyllus**, having broad leaves.
- Plicate**, folded lengthwise like a fan.
- Plumose**, with branches disposed like the plume on the shaft of a feather.
- Polyembryony**, with more than one embryo in the ovule.
- Polygamous**, with bisexual and unisexual flowers borne by the same species on one or on different individuals.

P—concluded.

- Pome**, a fruit like an apple; a succulent inferior many-celled fruit the seeds in dry cells with tough and hard lining; a drupe with cartilaginous endocarp.
- Posterior**, said of the portion of an axillary flower that faces towards the axis of inflorescence.
- Prickle**, a sharp pointed outgrowth of the epidermis.
- Procerus**, very tall.
- Procumbent**, lying for the whole or greater part of its length along or close to the ground.
- Protandrous**, said of a flower when the stamens mature before the stigma.
- Proximal**, nearest the base or starting point.
- Pruinose**, covered with waxy bloom or powder.
- Pruriens**, causing an itching sensation.
- Pseud-, pseudo-** (prefix), false.
- Puberulous**, with very short soft hairs or down.
- Pubescent**, with soft hairs or down.
- Pulverulentus**, powdered as if dusted.
- Pumilus**, low in stature.
- Punctate**, dotted with small glands.
- Puniceus**, scarlet or carmine.
- Putamen**, the hard bony endocarp of a drupe; the stone of a stone-fruit.
- Pygmæus**, dwarf.
- Pyrene**, one of the small stones in a drupe.

Q.

- Quadrante**, square.
- Quinate**, 5-nate, with the parts of the flower in fives.

R.

- Raceme**, a form of inflorescence in which the flowering axis is long and undivided, and the flowers arranged on either side are on equal or nearly equal pedicels; **Racemose**, in racemes or having the character of racemes.
- Rachis**, the prolongation of the petiole in a pinnate leaf or the prolongation of the peduncle of an inflorescence. Often loosely used to include the petiole or peduncle as the case may be.
- Radical**, relating to or springing from the root.

R—concluded.

- Rakh**, the open thorny bush forest found in the Punjab Plains.
- Ray**, one of the radiating branches of an umbel; **Ray florets**, the flowers borne on the circumference of the heads in Compositæ.
- Receptacle**, the portion of the axis of a flower that bears the sepals, petals, stamens and pistil; the short axis bearing the flowers in Compositæ.
- Regular**, when the parts of each whorl in a flower are alike.
- Reniform**, kidney-shaped.
- Repand**, with a slightly uneven margin; not quite sinuate.
- Repens**, prostrate and rooting.
- Reticulation**, the net-work made by the veins in many leaves; **Reticulate**, having veins in the form of a net-work.
- Retinaculum**, the hook-like funicle of many of the Acanthaceæ.
- Retuse**, having a shallow notch in a rounded apex.
- Revolute**, having the margin or apex of the leaf rolled back upon the undersurface.
- Rhizome**, a root-stock or stem of root-like appearance, prostrate or underground.
- Right** (twisted to the —, overlapping to the —, twining to the right). From left to right as viewed from outside in front of the coil or plant or flower bud.
- Rostrate**, beaked.
- Rosulate**, collected in a rosette; said of leaves when radical and arranged in a circle on or close to the ground.
- Rotate**, wheel-shaped; said of a regular gamopetalous corolla with short tube and flat spreading limb.
- Rubicaulis**, with a stem like a bramble.
- Rugose**, wrinkled; dim. **Rugulose**.
- Ruminatè**, marked by transverse lines or divisions like the albumen of the seed of the nutmeg.

S.

- Saccate**, swollen like a little bag, as the short spur of some petals.
- Sagittate**, shaped like the head of an arrow, *i.e.*, with two pointed downward directed basal lobes.

S—continued.

- Samara**, a dry indehiscent winged fruit.
- Sanguineus**, blood-red.
- Sarmentose**, bearing long slender branches or runners.
- Sativus**, cultivated.
- Scabrid**, roughish, somewhat scabrous.
- Scabrous**, rough to the touch.
- Scandent**, climbing.
- Scape**, a leafless flower stalk rising direct from the root-stock.
- Scarious**, dry, thin and membranous and not green.
- Schizocarp**, a general name for a dry fruit which on maturity splits into one-seeded portions.
- Scorpioid**, said of a form of unilateral inflorescence which is coiled inward from apex to base when young.
- Sebiferus**, producing vegetable wax.
- Sect**, completely divided from margin to midrib into distinct parts.
- Secund**, said when parts or organs are all turned to the same side of the supporting axis.
- Semi-** (in compounds), half.
- Sempervirens**, evergreen.
- Separius**, found growing in hedges.
- Septicidal**, a form of dehiscence of a ripe carpel, the split being through the dissepiments or lines of junction of the carpels.
- Septum**, any kind of partition whether a dissepiment or not.
- Seriate**, arranged in rows either transverse or longitudinal.
- Sericeus**, clothed with silky adpressed hairs.
- Serrate**, toothed like a saw with teeth directed forward; dim. **Serrulate**.
- Sessile**, without a stalk.
- Seta**, a bristle; **Setiform**, **Setaceous**, bristle-like; **Setula**, a minute bristle; **Setulose** bearing minute bristles.
- Sinensis**, indigenous to China.
- Sinuate**, having a strongly wavy margin.
- Sinus**, the space between the lobes of a leaf, a recess or re-entering angle.
- Spadix**, an inflorescence with sessile flowers on a thick fleshy axis usually enclosed in one or more sheathing bracts; the inflorescence of palms so called because enclosed in a spathe before full development.
- Spathe**, a large membranous sheath-like bract enclosing a flower-cluster.
- Speciosus**, beautiful.

S—concluded.

Spike, an inflorescence having a long undivided axis and sessile flowers; **Spicate**, arranged in spikes; **Spiciform**, spike-like.

Spikelet, a secondary spike; usually applied to the grasses in which one or more flowers are subtended by a common pair of glumes.

Spinous, **Spinose**, bearing spines, spine-like; **Spinescent**, ending in a sharp spine-like point, spine-like.

Standard, the large posterior petal of a papilionaceous flowers.

Stigmatose, relating to the stigma.

Stipe, a stalk or stalk-like support; **Stipitate** having a stipe, usually applied to an ovary carpel or gland, never to leaves, flowers or inflorescences.

Stipel, an appendage to a leaflet analogous to the stipule of a leaf; **Stipellate**, furnished with stipels.

Stipule, an appendage at the base of a leaf; **Stipulate**, furnished with stipules; **Stipular**, occupying the place of stipules.

Striate, marked with *striæ*, *i.e.*, minute furrows.

Strictus, close or narrow and upright, very straight.

Strobiliform, like a fir-cone.

Strophiolate, having a strophiole, or appendage at the hilum.

Suaveolens, sweet-scented.

Sub- (prefix), somewhat, almost or under.

Suberosus, corky.

Subulate, awl-shaped.

Suffrutescent, low somewhat woody and branching near the ground; **Suffruticose**, forming an under-shrub.

Sulcate, grooved or furrowed.

Superior, situated above; **-ovary**, one free from or inserted above the calyx.

Suture, a seam indicating the line of union of two parts.

Sylvestris, growing in woods.

Syncarpium, a fruit formed by the union of several carpels which have become compacted and fleshy.

Syncarpous, having united carpels.

T.

Terete, cylindrical, round in cross-section.

Ternate, three in a whorl or cluster.

T—concluded.

Ternatisect, a term applied to a compound leaf having three leaflets proceeding from the same point.

Tessellated, divided up into small squares.

Testa, the outermost coat of the seed.

Tetra- (in compounds), four.

Tetramerous, said of the flower when there are four members in each whorl.

Thyrsoïd, resembling a thyrusus.

Thyrusus, a contracted or ovate panicle.

Tingens, used in dyeing.

Tomentose, densely covered with short soft tangled hairs; **Tomentum**, a covering of tomentose hairs.

Torulose, cylindric with slight contractions at intervals.

Torus, the axis of a flower on which the floral organs are inserted. *Syn.* receptacle.

Trapezoidal, four-sided with only two of the sides parallel.

Tri- (in compounds), three.

Trichophyllus, with hairy leaves.

Trichotomous, divided with the divisions in threes.

Trigonus, three-angled.

Trimerous, said of the flower when there are three members in each whorl.

Triquetrous, three angled with the edges or faces concave, rendering the angles salient.

Truncate, ending abruptly as if the end had been cut off.

Tuber, the thickened portion of an underground stem.

Tubillus, the integument of an ovule prolonged into a tube having the functions of a style.

Tumid, swollen.

Turbinate, top-shaped, like a broad inverted cone.

Turgid, swollen, distended.

Twisted (in aestivation), with one margin of each petal within and the other without the coil. See *right* and *left*.

U.

Umbel, a form of inflorescence in which the pedicels radiate from the top of a common peduncle and are all of the same length.

Umbilicus, the hilum of a seed.

Umbonate, bearing a boss or conical protuberance.

U—concluded.

- Umbrosus**, growing in shady places.
Undulate, wavy, with a wavy margin.
Unilateral, arranged on one side of the axis.
Unisexual, having the stamens in one and the pistil in another flower.
Urceolate, urn-shaped, tubular but contracted at or below the mouth.
Utricle, a one-celled, one-seeded fruit with a thin, somewhat loose pericarp.

V.

- Vaginatus**, having a sheathing leaf base.
Valvate, with the margins of the members of a whorl exactly meeting without overlapping.
Velutinus, velvety, densely covered with short soft straight silky hairs.
Ventral, relating or attached to the front or inner angle of a carpel.
Ventricose, bulging or swollen on one side: dim. **Ventriculose**.
Verrucose, covered with wart-like excrescences.
Versatile, said of an anther attached by a point of the back to the apex of the filament so as to turn or swing readily.

V—concluded.

- Vestiture**, a general term for any covering.
Vexillary, pertaining to or nearest to the standard in a papilionaceous flower.
Villous, covered with long soft hairs.
Vimineus, with long flexible twigs.
Virgatus, long, slender, erect and scarcely branched.
Viscosus, covered with sticky secretion.
Volubilis, twining.

W.

- Whorl**, a circle of organs in the transverse plane around an axis.
Wings, the side petals of a papilionaceous flower.

X.

- Xerophytic**, said of plants that grow naturally in dry hot places.

Z.

- Zeylanicus**, indigenous to Ceylon.
Zygomorphic, capable of being bisected into similar halves by only one plane, bilaterally symmetrical.

Synopsis of the Families.

The distinguishing characters of the families have been selected with special reference to the plants described. In the body of the work under each family an account of the family as a whole will be found. The plants here mentioned all belong to the Phanerogams or flowering plants. They are divided as follows:—

A. Angiosperms. Ovules contained in a closed ovary, fertilized through the stigma and style.

I. Dicotyledons. Leaves net-veined. Parts of the perianth usually in fours or fives. Embryo with two cotyledons. *Families I—LXXXIX.*

(a) Polypetalæ. Flowers usually bisexual, usually with calyx and corolla, the latter consisting of distinct petals. *Families I—XLVII.*

(i) Thalamifloræ. Sepals usually distinct, petals and stamens hypogynous, disk usually absent, ovary free. *Families I—XVII.*

(ii) Discifloræ. Sepals distinct or connate, petals sometimes connate at the very base, torus usually expanded into a disk between the petals and the ovary, ovary often immersed in the disk. *Families XVIII—XXXV.*

(iii) Calycifloræ. Calyx usually of combined sepals, petals distinct or united at the base, disk thin or wanting, stamens perigynous or epigynous. *Families XXXVI—XLVII.*

(b) Gamopetalæ. Flowers usually bisexual, usually with calyx and corolla, the latter consisting of connate petals. *Families XLVIII—LXIX.*

(c) Monochlamydeæ. Flowers often unisexual, perianth-lobes or segments 1-seriate or if 2-seriate both usually calycine. *Families LXX—LXXXIX.*

II. Monocotyledons. Leaves on sheathed or broad-based petioles, the blade usually with parallel veins joined by undivided transverse veins. Parts of the perianth usually in threes or multiples of three. Embryo with one cotyledon. *Families XC—XCIV.*

B. Gymnosperms. Flowers unisexual, perianth none or incomplete. Ovules not enclosed in an ovary, fertilized by direct contact with the pollen-grain or through a tube formed by the integument. *Families XCV—XCVII.*

I. Dicotyledons.

(a) Polypetalæ.

(i) Thalamifloræ.

I. Ranunculaceæ. Herbs or climbing shrubs. Leaves alternate or opposite, compound. Sepals herbaceous, persistent or deciduous and petaloid when the petals are wanting. Stamens numerous. Ovaries 1-3, many-ovuled or numerous 1-ovuled. Fruit dry.

II. Magnoliaceæ. Trees, shrubs or climbers. Leaves alternate, simple. Sepals and petals alike in whorls of three, imbricate, deciduous. Stamens numerous. Carpels numerous, free or slightly cohering. Fruit a cone or spike.

- III. **Dilleniaceæ.** Trees. Leaves alternate, simple, with prominent lateral nerves. Sepals 5, imbricate, persistent. Petals 5, caducous. Stamens numerous, free. Carpels many, cohering at the axis. Fruiting carpels enclosed in the thickened sepals.
- IV. **Anonaceæ.** Trees or shrubs, often scrambling. Leaves alternate, entire, exstipulate. Sepals 3. Petals 6. Stamens numerous, free. Carpels numerous, free or (*Anona*) confluent. Fruit succulent.
- V. **Menispermaceæ.** Climbing shrubs or small trees. Leaves alternate, entire or lobed, usually palminerved, often peltate. Flowers small, unisexual, trimerous. Stamens as many as and opposite the petals or anthers sessile on a column. Ovaries 1 or 3, free. Fruit a drupe. Seed horse-shoe-shaped.
- VI. **Berberidaceæ.** Herbs or shrubs, erect or climbing, often armed. Leaves alternate, simple or compound. Petals and sepals similar, the later petaloid, usually in whorls of three. Stamens 6, opposite the petals, opening by slits or ascending valves. Carpels 1 or 3, free. Fruit a berry.
- VII. **Capparidaceæ.** Trees or shrubs, often scandent, sometimes armed. Leaves alternate, simple or digitate. Sepals 4. Petals 4. Stamens 4, 5 or many, filaments long, filiform. Ovary syncarpous with 2-4 parietal placentas, seated on a gynophore, style 0. Fruit a berry, various in shape and consistency.
- VIII. **Bixaceæ.** Trees or shrubs, often armed. Leaves alternate, simple, stipules 0 or minute. Flowers showy and bisexual or small and dioecious. Sepals 4-5. Petals 4-10 or 0. Stamens numerous, free. Ovary usually 1-celled, placentas 2-many, parietal. Fruit a berry or capsule.
- IX. **Pittosporaceæ.** Evergreen trees or shrubs. Leaves alternate, coriaceous, exstipulate. Flowers bisexual, 5-merous. Sepals and petals free or connate. Stamens 5, free. Ovary 1-celled with 2-5 parietal placentas or more or less 2-5-celled by the projection of the placentas. Fruit a leathery or woody capsule.
- X. **Tamaricaceæ.** Evergreen shrubs or trees. Leaves alternate, small or scale-like. Flowers small. Sepals and petals 5 each, free. Stamens 5 or 10, free or connate. Ovary 1-celled; placentas 3-5, basal. Fruit capsular. Seed plumose.
- XI. **Elatinaceæ.** Undershrubs. Leaves small, opposite, aromatic, stipulate. Flowers minute, solitary or in fascicles of 2-8, usually 5-merous. Sepals and petals free. Stamens 10, free. Ovary free, cells and styles as many as sepals. Fruit a capsule. Seeds minute.
- XII. **Hypericaceæ.** Shrubs. Leaves opposite, gland-dotted, exstipulate. Flowers yellow, bisexual. Sepals and petals 5 each, free. Stamens numerous, filaments long, filiform, 5-adelphous at the base. Ovary 5-celled. Fruit a capsule. Seeds very numerous, minute.
- XIII. **Ternstroemiaceæ.** Trees or shrubs. Leaves alternate, simple, exstipulate. Flowers bisexual, pentamerous. Sepals 5, free. Petals 5, more or less connate at

the base. Stamens 12-15 or numerous, adnate to the base of the petals. Ovary 3-5-celled. Fruit baccate or capsular.

XIV. **Dipterocarpaceæ.** Trees. Leaves alternate, entire, coriaceous, stipulate. Flowers yellowish in racemose panicles. Sepals 5, connate. Petals 5. Stamens up to 50, connective with a subulate appendage. Ovary 3-celled. Fruit with 3 long wings formed from the calyx-segments.

XV. **Malvaceæ.** Herbs, shrubs or trees. Leaves alternate, usually simple and palmnerved, stipulate. Flowers often with an involucre below the calyx. Sepals 5, valvate, more or less connate. Petals 5, united at the base to the staminal column. Stamens numerous, monadelphous or the tube dividing into 5 bundles of stamens; anthers 1-celled. Ovary syncarpous of 2-many carpels. Fruit dry, of dehiscent or indehiscent cocci or capsular (the capsule rarely succulent).

XVI. **Sterculiaceæ.** Herbs, shrubs or trees. Leaves alternate, simple, often palmately lobed, stipulate. Sepals 5, valvate, connate. Petals 5 or 0. Stamens in two series, those opposite the sepals reduced to staminodes or wanting, those opposite the petals monadelphous, usually indefinitely branched; anthers 2-celled. Ovary of 2-5 sub-distinct or connate carpels. Fruit dry capsular or of distinct follicles.

XVII. **Tiliaceæ.** Herbs, shrubs or trees. Leaves alternate, simple, usually palmnerved, stipulate. Sepals 4-5, free. Petals 4-5, free, often glandular at the base. Stamens 5-numerous, free; anthers 2-celled. Ovary 2-5-celled. Fruit drupaceous or capsular or dry and indehiscent or splitting into cocci.

(ii) **Disclifloræ.**

XVIII. **Linaceæ.** Shrubs. Leaves alternate, glabrous, stipules minute. Flowers yellow, regular, bisexual. Sepals and petals 5 each, free. Stamens 5, connate at the base with small interposed staminodes. Disk inconspicuous of 2-3 glands adnate to the staminal-tube. Ovary 3-5-celled, cells spuriously 2-locellate. Fruit a capsule.

XIX. **Malpighiaceæ.** Trees or shrubs, often climbing. Leaves opposite, simple, entire, stipules 0 or minute. Calyx 5-partite, one or more of the segments glandular outside or (*Aspidopterys*) eglandular. Petals 5, clawed and fimbriate or (*Aspidopterys*) not clawed and entire. Stamens 10, very shortly connate at the base. Disk obscure. Ovary 3-celled; styles 3 or 1. Fruit dry and winged or (*Malpighia*) drupaceous.

XX. **Zygophyllaceæ.** Undershrubs. Leaves opposite, 1-3-foliate, stipules spinescent. Flowers small. Sepals and petals 5 each, free. Stamens 10, free. Disk inconspicuous. Ovary 5-celled. Fruit of 5 one-seeded cocci.

XXI. **Geraniaceæ.** Evergreen trees. Leaves alternate, imparipinnate, stipules 0. Flowers small, pink. Sepals and petals 5 each, free. Stamens 10, connate at the base, five of them usually shorter and without anthers. Disk 0. Ovary 5-celled. Fruit yellowish, fleshy, 5-ribbed or angled.

- XXII. Rutaceæ. Trees or shrubs, often armed. Leaves alternate or (*Acronychia*) opposite, gland-dotted, aromatic, simple or compound, stipules 0. Flowers regular. Sepals and petals 4-5, the latter free. Stamens 4, 5, 8, 10 or numerous. Disk usually conspicuous, intrastaminal. Ovary of 4-5 usually connate carpels or (*Zanthoxylum*) of 1-3 free carpels. Fruit a more or less succulent drupe or berry.
- XXIII. Simarubaceæ. Trees or shrubs, armed or not. Leaves alternate, pinnate or bifoliate. Flowers small, usually unisexual. Calyx 4-5-lobed or -partite. Petals 4-5, free. Stamens as many, or twice as many as the petals, free, inserted at the base of the disk. Carpels 2-5, free or connate. Fruit a drupe or of drupes or samaras.
- XXIV. Burseraceæ. Trees or shrubs, sometimes armed, balsamiferous. Leaves alternate or pinnate or 1-3-foliate. Flowers small. Calyx 4-5-lobed. Petals 4-5, free. Stamens 8 or 10, free, inserted on or outside the disk. Ovary 3-5-celled. Fruit drupaceous or pseudocapsular.
- XXV. Meliaceæ. Trees. Leaves alternate, pinnate or bi- or tripinnate, exstipulate. Flowers regular, usually small. Calyx 4-6-fid. Petals 4-6, free. Stamens 8-12, united into a tube or (*Cedrela*) free. Disk intrastaminal or (*Cedrela*) the stamens inserted on the disk. Ovary 3-6-celled, fruit a drupe or capsule.
- XXVI. Olacaceæ. Undershrubs. Leaves alternate, sessile, glabrous, exstipulate. Flowers small, solitary, axillary. Calyx minute, cupular. Petals 3, valvate, loosely cohering. Disk small. Fertile stamens 3, adnate to the petals, staminodes 6, more or less adnate to the margins of the petals. Ovary 1-celled or at the base imperfectly 3-celled. Fruit a drupe.
- XXVII. Illicaceæ. Evergreen trees. Leaves alternate, coriaceous stipules minute. Flowers small, usually dioecious. Calyx 4-5-fid, persistent. Petals 4-5, connate below in male flowers. Stamens 4-5-uniting the bases of the petals. Disk 0. Ovary 2-5-celled. Fruit a drupe.
- XXVIII. Celastraceæ. Trees or shrubs, sometimes armed, rarely climbing. Leaves opposite or alternate, simple, stipules small or 0. Flowers small. Calyx 4-5-lobed or -partite. Petals 4-5, free. Stamens 4-5, inserted on the disk or beneath the margin of it. Disk conspicuous, surrounding the base of the ovary. Ovary 2-5-celled. Fruit a capsule or drupe.
- XXIX. Rhamnaceæ. Trees or shrubs, erect or climbing, sometimes armed. Leaves alternate or opposite, simple, usually stipulate. Flowers small, greenish. Calyx 4-6-fid. Petals 4-6 or 0, usually hooded over the stamens. Stamens opposite the petals. Disk filling or lining the calyx-tube. Ovary 2-4-celled, sometimes partially or wholly inferior. Fruit drupaceous or capsular, the capsule sometimes winged.
- XXX. Vitaceæ. Climbing or erect shrubs, under-shrubs or herbs. Leaves alternate, simple or compound, stipulate. Flowers small, usually greenish. Calyx entire or 4-5-lobed. Petals 4-5, free or connate at the base or connate at the apex and falling off as a cap. Stamens 4-5, opposite to the petals, free or (*Leea*)

connate into a tube which is adnate to the petals. Disk intrastaminal, usually conspicuous. Ovary 2-6 celled. Fruit a berry.

XXXI. Sapindaceæ. Trees or shrubs. Leaves opposite or alternate, compound, or (*Acer* some species and *Dodonaea*) simple. Calyx of 4-5 lobes or sepals. Petals 4-5 free or 0. Disk various, usually conspicuous. Stamens 5-10, free. Ovary 1-4-celled, entire or more or less deeply divided. Fruit various.

XXXII. Sabiaceæ. Trees or climbing shrubs. Leaves alternate, simple, stipules 0. Calyx 4-5-partite. Petals 4-5, opposite the sepals. Stamens 5, opposite the petals, all or 2 only fertile. Disk intrastaminal. Ovary of 2-3 carpels or cells. Fruit a drupe.

XXXIII. Anacardiaceæ. Trees or shrubs, sometimes armed. Leaves alternate, simple, 3-foliate or pinnate, stipules 0. Flowers small. Calyx 1-6-partite. Petals 4-5 or (*Pistacia*) 0. Stamens 4-10, usually inserted outside, rarely on the disk. Ovary 1-celled or (*Spondias*, *Pleiogynium*) 4-5-12-celled. Fruit drupaceous, dry or succulent.

XXXIV. Coriariaceæ. Shrubs, glabrous. Leaves opposite, stipules 0. Flowers small, greenish, in axillary racemes. Sepals 5, persistent. Petals 5, persistent. Stamens 10, free. Disk 0. Carpels 5, free. Ripe carpels enclosed in the succulent purple petals.

XXXV. Moringaceæ. Trees, large, deciduous. Leaves alternate 2-3-pinnate, stipules 0. Flowers large, irregular. Calyx cup-shaped 5-cleft, segments unequal, petaloid. Petals 5, unequal. Disk lining the calyx-tube. Stamens 5, fertile, opposite the petals, alternating with staminodes. Ovary 1-celled with 3 parietal placentas. Fruit a 3-valved capsule.

(iii) Calycifloræ.

XXXVI. Leguminosæ. Herbs, shrubs or trees, sometimes climbing, often armed. Leaves alternate, 1-foliate or compound, usually stipulate. Flowers usually zygomorphic and bisexual. Sepals 5, free or connate. Petals 5 or rarely fewer by abortion or (*Ceratonia*, *Saraca*) 0. Stamens 10, rarely fewer, or numerous, free or connate. Carpel 1, free. Fruit a pod.

XXXVII. Rosaceæ. Herbs, shrubs or trees, sometimes scrambling, often armed. Leaves alternate, simple or compound, usually stipulate. Flowers regular, pentamerous or (*Rosa sericea*) tetramerous, or in cultivation petals indefinite. Stamens usually indefinite. Carpels 1-many, usually distinct, often adnate to and enclosed in the calyx-tube. Fruit various.

XXXVIII. Saxifragaceæ. Herbs, shrubs or trees, erect or (*Hydrangea*) climbing, unarmed or (*Ribes Grossularia*) prickly. Leaves alternate or opposite, simple. Flowers regular, 4-5-merous. Stamens as many or twice or thrice as many as petals, or (*Philadelphus*) numerous. Ovary of 2-5 carpels, 1-5-celled, inferior or (*Itea*) half superior. Fruit a capsule or (*Ribes*) berry.

- XXXIX. **Hamamelidaceæ.** Shrubs, deciduous. Leaves alternate, simple, stipulate. Flowers minute, greenish, in ovoid heads, surrounded by 4 large white bracts. Petals 0. Stamens about 15. Ovary 2-celled, semi-inferior. Fruit a capsule.
- XL. **Combretaceæ.** Trees, shrubs or undershrubs, often climbing. Leaves alternate, sub-opposite or opposite, simple, entire, exstipulate. Flowers 4-5-merous, regular. Petals often wanting. Stamens 8 or 10, biseriate, the lower opposite the calyx-lobes, the upper opposite the petals. Ovary 1-celled, inferior. Fruit dry, indehiscent, usually angled or winged.
- XLI. **Myrtaceæ.** Trees or shrubs. Leaves opposite or alternate, usually entire, evergreen and gland-dotted (epunctate in *Careya* and *Barringtonia*), exstipulate. Flowers regular, 4-5-merous. Petals sometimes united into a cap. Stamens numerous, filaments filiform, free or connate into a tube or into bundles. Ovary fused to the calyx-tube, 1-many-celled. Fruit a berry, drupe or capsule.
- XLII. **Melastomaceæ.** Herbs or shrubs. Leaves opposite, simple, exstipulate. Flowers regular, showy, 4-5-merous. Calyx-tube partially adnate to the ovary. Petals free. Stamens twice as many as the petals; anthers longer than the filaments, curved, opening by apical pores. Ovary usually 4-celled. Fruit a capsule. Seeds many, minute.
- XLIII. **Lythraceæ.** Trees or shrubs, often armed. Leaves opposite or subopposite or whorled, exstipulate. Flowers regular or (*Woodfordia*) oblique. Calyx, lobes 3-6. Petals usually as many as calyx-lobes often crumpled. Stamens 8, 12 or many. Ovary superior or (*Punica*) inferior. Ovary 2-6- or (*Punica*) many-celled. Fruit a capsule or (*Punica*) berry-like.
- XLIV. **Samydaceæ.** Trees, small, deciduous. Leaves alternate, pellucid-punctate, stipulate. Flowers small, regular. Calyx persistent, deeply 4-5-lobed. Petals 0. Stamens 6-10, alternating with staminodes, free or connate. Ovary free, 1-celled; placentas, 3-4, parietal. Fruit a succulent, 3-4-valved capsule.
- XLV. **Cactaceæ.** Stem and branches jointed, succulent, prickly. Leaves minute or 0. Flowers showy. Sepals and petals alike, numerous, free or united into a tube. Stamens very numerous, anthers minute. Ovary 1-celled, adnate to the calyx-tube or inferior. Fruit a berry.
- XLVI. **Araliaceæ.** Shrubs, climbing, evergreen, rarely erect herbs. Leaves alternate, simple or compound, stipulate or (*Hedera*) exstipulate. Flowers small, regular, in umbels. Calyx-tube adnate to the ovary. Petals 5, free. Stamens 5, free, inserted round an epigynous disk. Ovary inferior, 5-celled. Fruit a small berry.
- XLVII. **Cornaceæ.** Trees, usually small. Leaves opposite or alternate, stipules 0. Flowers regular. Calyx-tube adnate to the ovary. Petals 4-8, free, valvate. Stamens 4-8, free, inserted round an epigynous disk. Ovary inferior, 2 (-3)-celled. Fruit drupaceous.

(b) Gamopetalæ.

- XLVIII. **Caprifoliaceæ.** Shrubs or small trees, climbing (*Lonicera* exotic species), or erect, unarmed (*Lonicera spinosa*, spinescent). Leaves opposite, stipules minute or wanting. Flowers regular or zygomorphic. Calyx-tube adnate to the ovary. Corolla gamopetalous, 5-lobed. Stamens 5, inserted on the corolla. Ovary inferior, 1-5-celled. Fruit a drupe or berry or dry or capsular.
- XLIX. **Rubiaceæ.** Trees or shrubs, sometimes armed. Leaves opposite or whorled, entire, stipules inter- or intrapetiolar, conspicuous. Flowers regular, usually 4-5-merous. Calyx-tube adnate to the ovary. Corolla gamopetalous. Stamens as many as corolla-lobes, inserted on the corolla. Ovary inferior 2- or 5-celled. Fruit usually a berry, drupe or capsule.
- L. **Compositæ.** Herbs or shrubs. Leaves alternate, radical, or (*Montanoa*) opposite; stipules 0. Flowers in heads surrounded by an involucre of bracts. Calyx-tube adnate to the ovary, limb 0 or of hairs or scales. Corolla gamopetalous, tubular or ligulate. Stamens 4-5, inserted on the corolla, anthers connate into a sheath round the style. Ovary inferior, 1-celled. Fruit an achene, often with a tuft of hairs.
- LI. **Ericaceæ.** Trees, shrubs or undershrubs. Leaves alternate or crowded, usually coriaceous, stipules 0. Flowers 4-5-merous. Corolla campanulate or ovoid. Stamens 6-10, often inserted on the corolla. Ovary 4-9-, usually 5-celled, superior. Fruit a capsule (in *Gaultheria* enclosed in the fleshy calyx and appearing baccate).
- LII. **Plumbaginaceæ.** Shrubs or undershrubs. Leaves alternate or rosulate, stipules 0. Flowers regular. Calyx gamosepalous, more or less tubular, persistent. Corolla salver-shaped, 5-lobed or of 5 petals. Stamens as many as, opposite and adnate to the bases of the corolla-lobes or petals. Ovary 1-celled, 1-ovuled. Fruit dry, included in the calyx.
- LIII. **Myrsinaceæ.** Trees or shrubs. Leaves alternate, simple, sometimes with resinous glands, stipules 0. Flowers small, regular, 4-5-merous. Calyx persistent. Corolla-tube short or petals free. Stamens as many as, opposite and adnate to or inserted on the corolla-lobes or petals. Ovary 1-celled, superior or (*Mæsa*) half-inferior. Fruit small, dry or succulent.
- LIV. **Sapotaceæ.** Trees or shrubs, unarmed, with milky juice or (*Monotheca*) armed and without milky juice. Leaves entire, simple, usually coriaceous. Flowers regular. Sepals 4-8, nearly distinct, persistent. Corolla-tube short, lobes 5-24. Stamens as many as and opposite the corolla-lobes, or 2-3-times as many, inserted on the corolla. Ovary 1-12-celled, superior. Fruit a drupe or berry.
- LV. **Ebenaceæ.** Trees or shrubs, sometimes spinous. Leaves alternate or sub-opposite, simple, entire, exstipulate. Flowers dioecious, 4-5-merous. Calyx gamosepalous. Corolla gamopetalous. Stamens 12-64, filaments variously connate, often in pairs. Staminodes in female flowers usually fewer than the stamens in

- male flowers. Ovary 4-8-celled, superior. Fruit a berry seated on the enlarged coriaceous calyx, rind coriaceous, seeds embedded in soft or viscid pulp.
- LVI. *Styracææ*. Small trees, deciduous. Leaves alternate, simple, stipules 0. Flowers white, regular, 5-merous. Petals connate below. Stamens 20-60, adnate to the bases of the petals. Ovary inferior, 2-celled. Fruit drupaceous.
- LVII. *Oleaceæ*. Shrubs or trees, sometimes twining. Leaves opposite or (*Jasminum*) alternate, simple or (*Jasminum*) compound, exstipulate. Flowers regular. Calyx 4-9-toothed, or truncate, rarely (*Fraginus*) 0. Corolla gamopetalous, 4-12-lobed or (*Fraginus*) 0. Stamens 2, inserted on the corolla or (*Fraginus*) hypogynous. Ovary 2-celled, free. Fruit a berry, drupe, capsule or winged nut.
- LVIII. *Salvadoraceæ*. Trees or shrubs. Leaves opposite, simple, entire, evergreen, stipules minute. Flowers small, green, panicled, 4-merous. Petals slightly connate below. Stamens 4, alternating with the petals and adnate to their bases. Ovary 1-celled. Fruit a small globose drupe.
- LIX. *Apocynaceæ*. Trees, shrubs or herbs, often twining usually with milky juice, sometimes armed. Leaves opposite or whorled or arranged spirally, stipules 0. Flowers regular, bisexual, 5-merous. Stamens 5, inserted on the corolla-tube, anther free or adhering to the stigma, pollen granular. Ovary of 2 distinct or connate carpels, superior. Fruit of 1 or 2 dry or fleshy drupes or of 2 free or connate follicles. Seed often with a tuft of hairs.
- LX. *Asclepiadaceæ*. Herbs or shrubs, mostly twining, usually with milky juice. Leaves opposite or wanting, stipules 0. Flowers regular, bisexual, 5-merous. Stamens 5, inserted at the base of the corolla, filaments free or united in a column, anthers free or united into a tube adnate to the stigma, pollen in each cell united into 1 or 2 granular or waxy masses. Ovary of 2 carpels united only by the stigma. Fruit of 1 or 2 follicles. Seed with a tuft of hairs.
- LXI. *Loganiaceæ*. Shrubs. Leaves opposite, stipules represented by a raised line between the petioles. Flowers 4-5-merous, bisexual. Stamens as many as corolla-lobes, inserted on the corolla-tube. Ovary 2-celled. Fruit a capsule or (*Nicodemia*) a berry.
- LXII. *Boraginaceæ*. Trees, shrubs or undershrubs. Leaves alternate or opposite, stipules 0. Flowers regular usually 5-merous. Calyx inferior, persistent in fruit. Stamens inserted on the corolla-tube as many as corolla-lobes. Ovary 2- or 4-celled, ovules 4. Fruit drupaceous or dividing into nutlets.
- LXIII. *Convolvulaceæ*. Shrubs, undershrubs or herbs, often twining. Leaves alternate or (*Cuscuta*) wanting, exstipulate. Flowers regular, 5-merous. Sepals free or shortly connate, persistent. Corolla often plicate in bud. Stamens 5, inserted on the corolla. Ovary 1-4-celled, superior, ovules 4. Fruit a capsule or baccate.

- LXIV. **Solanaceæ.** Herbs or shrubs, sometimes scandent, often armed. Leaves alternate (or falsely opposite), stipules 0. Flowers regular, usually 5-merous. Calyx usually persistent. Corolla often plicate in bud. Stamens inserted on the corolla. Ovary normally 2-celled, superior. Fruit a berry or capsule.
- LXV. **Scrophulariaceæ.** Trees or shrubs. Leaves simple opposite or whorled, stipules 0. Flowers zygomorphic, 5-merous. Corolla more or less 2-lipped. Stamens 4, didynamous. Ovary 2-celled, superior. Fruit a capsule, seeds many.
- LXVI. **Bignoniaceæ.** Trees or shrubs, often climbing. Leaves opposite, compound or (*Tecoma undulata*) simple, stipules 0. Flowers showy, zygomorphic, 5-merous. Corolla, more or less 2-lipped. Stamens 4, didynamous or (*Oroxylum*) 5 or (*Catalpa*) 2, with or without staminodes. Ovary 2-celled, superior. Fruit a capsule, seeds usually winged.
- LXVII. **Acanthaceæ.** Shrubs, undershrubs or herbs, rarely (*Thunbergia*) climbing often prickly. Leaves simple, opposite or (*Blepharis*) whorled. Flowers usually zygomorphic. Calyx 4-5-partite. Corolla subequally 5-lobed or 2-lipped. Stamens 4 or 2, inserted on the corolla. Ovary 2-celled, superior. Fruit a capsule, seeds orbicular, compressed.
- LXVIII. **Verbenaceæ.** Shrubs or trees, sometimes rambling or climbing. Leaves opposite or whorled, simple or (*Pilea*) digitate, stipules 0. Flowers usually zygomorphic, usually 4-5-merous. Stamens 4, didynamous or (*Callicarpa*) equal, inserted on the corolla. Ovary usually 4-celled, superior. Fruit drupaceous.
- LXIX. **Labiataæ.** Shrubs or undershrubs, rarely (*Otostegia*) spiny, stem usually quadrangular. Leaves opposite simple, stipules 0. Flowers usually zygomorphic. Calyx persistent, gamosepalous. Stamens 4 or 2, inserted on the corolla. Ovary 4-lobed or -partite, ovules 4. Fruit of dry nutlets.
- (c) **Monochlamydeæ.**
- LXX. **Nyctaginaceæ.** Thorny scandent evergreen shrubs. Leaves alternate, entire, stipules 0. Flowers bisexual, small, yellow, 3 together each adnate to a large showy colored bract. Perianth monophyllous, petaloid. Stamens 7-8, included. Ovary 1-celled, free, ovule 1. Fruit an utricle.
- LXXI. **Amarantaceæ.** Shrubs or undershrubs. Leaves opposite or alternate, stipules 0. Flowers usually bisexual, small, spicate. Perianth of 5 free or connate, hyaline or scarious segments. Stamens 5, opposite the perianth-segments, filaments connate below without or (*Eruca*) with interposed staminodes. Ovary 1-celled, free. Fruit a berry or utricle.
- LXXII. **Chenopodiaceæ.** Shrubs or undershrubs, usually more or less succulent. Leaves alternate, opposite or 0. Flowers small, 2-1-sexual. Perianth of 3-5 more or less connate sepaloid segments (wanting in female flowers in *Eurotia*). Stamens 5 or fewer, opposite the sepals. Ovary 1-celled, free, ovule 1. Fruit an utricle enclosed in the persistent perianth.

- LXXXIII. **Phytolaccaceæ.** Undershrubs. Leaves alternate, stipules minute. Flowers small, white, bisexual. Perianth 4-partite, coralline. Stamens 4, alternating with the petals, inserted on a small disk. Ovary 1-celled, free, seed 1. Fruit red, juicy.
- LXXXIV. **Polygonaceæ.** Herbs or shrubs, sometimes (*Antigonum*) climbing. Leaves alternate, often scanty, stipules usually sheathing. Flowers usually small and bisexual. Perianth-segments 3-6, persistent. Stamens 6-12, opposite the perianth-segments. Ovary 1-celled, free, 2-4-angled, ovule 1. Fruit a nut, enclosed in the perianth (except *Calligonum*).
- LXXXV. **Piperaceæ.** Shrubs. Leaves alternate, stipulate. Flowers dioecious, spicate, purple. Perianth 0. Stamens 2, anthers reniform, the cells confluent. Ovary 1-celled, stigmas 3. Fruit a globose 1-seeded berry.
- LXXXVI. **Lauraceæ.** Trees. Leaves alternate, rarely (*Cinnamomum*) opposite, evergreen, entire (toothed in *Laurus*), stipules 0. Flowers small, regular. Perianth inferior, tube short, lobes 6 (*Laurus* 4), sepaloid. Stamens in 3-4 series, the outer opposite the perianth-segments, the inner usually reduced to staminodes, anthers opening by valves. Ovary 1-celled, free, ovule 1. Fruit a berry or drupe.
- LXXXVII. **Proteaceæ.** Trees. Leaves alternate or whorled, evergreen, stipules 0. Flowers in racemes. Perianth monophyllous, petaloid, tubular, shortly 4-lobed, lobes valvate. Stamens 4, sessile at the base of the corolla-lobes. Ovary 1-celled, free, ovules 2. Fruit a follicle or drupe.
- LXXXVIII. **Thymelæaceæ.** Shrubs. Leaves alternate or opposite, simple, entire, stipules 0. Flowers regular, bisexual. Perianth monophyllous, petaloid, tubular below, limb 4-5-lobed, lobes imbricate. Stamens twice as many as perianth-lobes, biseriate, inserted on the perianth, the outer opposite its lobes and at a higher level than the inner. Ovary 1-celled, free, ovule 1. Fruit a small berry.
- LXXXIX. **Elæagnaceæ.** Shrubs or trees, usually thorny. Leaves alternate, entire, clothed beneath with silvery scales or hairs, stipules 0. Flowers small, regular, 4-fid, 2-partite or obscurely 2-lobed. Stamens 4, inserted on the perianth. Ovary 1-celled, free, ovule 1. Fruit a false drupe, succulent.
- LXXX. **Loranthaceæ.** Parasitic shrubs. Leaves usually opposite or wanting, entire, thick, stipules 0. Perianth simple or double. Stamens as many as and opposite the perianth lobes. Ovary inferior, apparently solid. Fruit a berry or drupe, usually viscid.
- LXXXI. **Santalaceæ.** Shrubs. Leaves alternate, entire, stipules 0. Flowers minute, greenish. Perianth-limb 3-lobed. Stamens 3, inserted on and opposite the perianth-lobes. Ovary 1-celled, inferior, ovules 2-4. Fruit a drupe.
- LXXXII. **Euphorbiaceæ.** Herbs, shrubs or trees, sometimes armed, often with milky juice. Leaves usually alternate, simple or (*Bischofia*) trifoliate, usually stipulate. Flowers unisexual, usually small. Perianth simple, calycine or (*Flueggea*) subpetaloid or double

with calyx and corolla or (*Euphorbia*, *Synadenium*) 0. Stamens 1-many. Ovary usually of 3 more or less united carpels, superior, ovules 1-2 in each carpel. Fruit usually a 3-valved capsule sometimes more or less succulent or a drupe or berry.

LXXXIII. **Urticaceæ.** Trees, shrubs or herbs, often with milky juice. Leaves usually alternate, stipulate. Flowers small or minute, 1-2-sexual, sometimes crowded on globose or hollow receptacles. Perianth simple, calycine or (*Forskohlea*, female flowers) 0. Stamens as many as and opposite the perianth-segments or fewer. Ovary 1-celled, superior, ovule 1. Fruit a drupe, samara or achene or composed of a confluent mass of perianths and pericarps.

LXXXIV. **Platanaceæ.** Large deciduous trees. Leaves alternate, palminnerved and lobed, stipules large amplexicaul, caducous. Flowers minute, monœcious in globose heads, 3-4-merous. Sepals and petals minute, scale-like. Stamens and carpels as many as sepals, both free, ovules 1-2 in each carpel. Fruit a globose head of achenes.

LXXXV. **Juglandaceæ.** Deciduous trees. Leaves alternate, pinnate, stipules 0. Flowers small, monœcious. Male flowers in catkins. Female flowers in few- or many-flowered spikes. Perianth adnate to the ovary. Ovary inferior, 1-celled, of 2 carpels, ovule 1. Fruit a drupe or nut.

LXXXVI. **Myricaceæ.** Small evergreen trees. Leaves alternate entire dotted with resin beneath, stipules 0. Flower minute, unisexual, in cylindric bracteate spikes. Perianth 0. Stamens 3-6. Ovary 1-celled, of 2 carpels, ovule 1. Fruit a drupe.

LXXXVII. **Casuarinaceæ.** Leafless trees. Branchlets whorled, jointed, grooved. Flowers unisexual. Male flowers in terminal cylindric spikes, perianth-segments 2, hooded over the solitary stamens. Female flowers in cones, perianth 0, ovary 1-celled, of 2 carpels, ovules 1-2. Fruit a small woody cone, opening by valves and liberating the small seed-like winged nuts.

LXXXVIII. **Cupuliferæ.** Trees. Leaves alternate, simple, stipulate. Flowers monœcious. Male flowers in catkins or (*Castanea*) erect androgynous spikes. Female flower in spikes, heads or solitary, perianth adnate to the ovary or 0, ovary inferior or naked, usually solid in flower and more or less 2-3-celled after fertilization, ovules 1 or 2. Fruit a nut.

LXXXIX. **Salicaceæ.** Deciduous trees or shrubs. Leaves alternate, simple. Flowers unisexual, in catkins, each flower in the axil of a bract, perianth 0, disk of 1 or more glands or cup-shaped. Stamens 2 or more, usually free. Ovary 1-celled, placentas 2-4, parietal. Fruit a capsule. Seed cottony.

II. Monocotyledons.

XC. **Amaryllidaceæ.** Rootstock produced into a short or fairly long woody trunk. Leaves rosulate, long and narrow, thick, fleshy, usually armed with marginal prickles and a terminal spine. Inflorescence a huge panicle. Flowers large. Perianth of 6 lobes or segments. Stamens 6, adnate to the perianth. Ovary 3-celled, inferior. Fruit a capsule.

- XCI. **Dioscoreaceæ.** Twining herbs. Leaves alternate or opposite, simple or digitate, petiole twisted at the base, never cirrhose. Flowers small, unisexual. Perianth 6-lobed. Stamens 6, or 3 with 3 staminodes. Ovary 3-celled, inferior. Fruit a 3-winged capsule.
- XCII. **Liliaceæ.** Shrubs or herbs, often climbing, sometimes armed. Leaves alternate or replaced by cladodes, petiole sheathed. Perianth of 6 free or (*Cordylina*) shortly connate segments. Stamens 6 or (*Ruscus*) 3. Ovary 3-celled, superior. Fruit a berry.
- XCIII. **Palmæ.** Shrubs or trees, often spiny, sometimes climbing, stem solid. Leaves alternate, pinnate or flabelliform. Flowers small in spikes or panicles. Perianth of 6 lobes or segments. Stamens usually 6. Ovary 1-3-celled or of 3 carpels, ovules 1 in each cell or carpel. Fruit usually a drupe.
- XCIV. **Gramineæ.** Stems more or less tufted, woody or herbaceous, hollow, jointed. Leaves linear, lanceolate or oblong, jointed on to a sheath which is amplexicaul and split to the base. Flowers small in spikelets, each flower in the axil of a bract. Perianth much reduced and inconspicuous. Stamens 3 or 6. Ovary 1-celled, superior, ovule 1. Fruit a caryopsis.
- B. Gymnosperms.**
- XCV. **Gnetaceæ.** Leafless shrubs, sometimes climbing, branchlets jointed. Flowers small, unisexual. Male flowers in small bracteate spikes, perianth 2-lobed, anthers 2-8, sessile on a column, 2-celled. Female flowers 1-3 together, bracteate, ovule 1 in each flower, enclosed in a perianth which becomes fleshy in fruit.
- XCVI. **Coniferæ.** Trees or shrubs, evergreen (except *Ginkgo*), usually resinous. Leaves usually needle-like or scale-like. Flowers unisexual, perianth 0. Male flowers in deciduous catkins consisting of scale-like stamens. Female flowers in cones which usually become woody in fruit or reduced to a single ovuliferous scale or a single ovule.
- XCVII. **Cycadaceæ.** Small trees. Leaves large, pinnate, crowded at the end of the stem. Flowers dioecious. Male flowers in erect cones formed of thick scale-like stamens bearing on the lower surface numerous globose anther-cells. Female flowers reduced to single ovules borne on the margin of imperfectly developed leaves, 2-8 ovules on each.

The following genera and families have exceptional characters. Introduced genera and species are shown in italics :—

Dicotyledons—

Trimerous flowers are the rule in the *Magnoliaceæ*, *Anonaceæ*, *Menispermaceæ*, *Berberidaceæ* and *Lauraceæ*. They are also found in the genera *Rumex* and *Rheum* (*Polygonaceæ*) and in a few others.

Polypetalæ—

The calyx is obscure being adnate to the ovary and not produced beyond it in many *Myrtaceæ* and *Araliaceæ*.

The sepals are not or scarcely differentiated from the petals in the *Magnoliaceæ*, *Berberidaceæ* and *Cactaceæ*.

The petals are wanting in *Clematis*, *Flacourtia*, *Xylosma*, *Sterculia*, *Heritiera*, *Zanthoxylum*, *Rhamnus* (some species), *Acer saccharum*, *Schleichera*, *Dodonaea*, *Nephelium*, *Pistacia*, *Ceratonia*, *Saraca*, *Hydrangea* (sterile flowers), *Parrotia*, *Terminalia*, *Anogeissus* and *Casearia*.

The petals are more or less connate in *Cissampelos* (male flowers, 1 petal only in female flowers), *Pittosporum* (some species), *Eurya*, *Saurauja*, *Camellia*, the *Malvaceae*, *Ola*, *Ilex* (male flowers), the *Vitaceae*, the *Leguminosae* (usually), *Hydrangea* (fertile flowers), *Eugenia*, *Jambolana*, and *Eucalyptus*.

Thalamiflorae—

The sepals are connate in *Mærua*, *Shorea*, the *Malvaceae* and *Sterculiaceae*.

The disk is conspicuous in *Cadaba* (tubular), *Mærua*, *Cratæva*, *Flacourtia* (female flowers), *Xylosma* and the *Tamaricaceae*.

Disciflorae—

The disk is inconspicuous or wanting in the *Linaceae*, the *Malpighiaceae*, *Egonia*, *Averrhoa*, *Azadirachta*, *Ilex*, *Vitis* semicordata, *Dodonaea* (male flowers) and *Coriaria*.

Calyciflorae—

The Calyx is composed of free sepals in *Opuntia*, it is very deeply divided so as to appear polysepalous in many of the *Casalpinioideae*.

Gamopetalae—

The Calyx is wanting or adnate to the ovary and not or scarcely produced beyond it in *Lonicera* (some), *Mitragnya*, *Rubia*, the *Compositae*, *Fraxinus*, *Xanthoxyloides* and *excelsior*, and *Ligustrum*.

The petals are free or nearly so in *Acantholimon*, *Myrsine*, *Embelia*, *Ardisia*, *Symplocos*, *Linociera* and *Salvadora*.

The petals are wanting in *Fraxinus*.

Monochlamydeae—

The perianth is petaloid in *Bougainvillea*, *Rivina*, *Calligonum*, *Antigonum*, *Grevillea*, *Macadamia*, *Daphne*, *Wikstroemia*, and *Elæagnus*.

The perianth is composed of calyx and petaloid corolla in *Loranthus*, *Jatropha* and *Aleurites*. In many other genera of the *Euphorbiaceae* the perianth is more or less differentiated into a calyx and corolla.

The perianth is wanting in *Eurotia* (female flowers), *Piper*, *Euphorbia*, *Synadenium*, *Forskohlea* (female flowers), *Myrica*, *Casuarina* (female flowers), *Carpinus* (male flowers), *Salix* and *Populus*. In most genera of the *Cupuliferae* the perianth is very obscure and often only represented by bracteoles. This is also the case in *Platanus*.

Monocotyledons—

The leaves are net-veined in *Dioscorea* and *Smilax*.

The leaves are wanting and replaced by cladodes in *Asparagus* and *Ruscus*.

The flowers in the *Gramineae* are situated between distichous bracts, the perianth being quite obscure.

A FOREST FLORA FOR THE PUNJAB WITH HAZARA AND DELHI.

I. **RANUNCULACEÆ.**

Herbs of various habit, rarely climbing shrubs. Leaves radical or alternate, rarely opposite. Flowers usually bisexual and regular, always hypogynous. Sepals usually 5, free; petaloid when the petals are wanting, or rudimentary; imbricate or valvate. Petals 0 or 3-5 or more. Stamens usually numerous, free; anthers dehiscing by slits. Carpels usually many, free, 1-celled; ovules numerous, biseriate or solitary and basal. Fruit of one or more achenes, or many-seeded follicles, rarely a berry. **DISTRIB.** A large family mainly in cool and temperate regions.

The family contains many ornamental flowering plants common in the Himalaya, some of which are of medicinal value.

The following is the only woody genus:—

CLEMATIS, Linn.

(From the Greek *klema*, a vine branch; most species are climbers.)

Undershrubs or woody climbers, climbing by means of their leaf-stalks. Leaves opposite, simple, trifoliate, pinnate or decomposed; stipules 0. Flowers solitary or fascicled or panicked, axillary or terminal. Sepals 4, petaloid. Petals 0. Stamens and carpels numerous. Fruit a head of achenes, conspicuous by the persistent styles which grow out into long feathery tails. **DISTRIB.** Species about 170; all temperate regions, rarer in the tropics.

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|--|-----------------------------|
| Leaves ternate; flowers on long stalks. | |
| Flowers white | 1. <i>C. montana.</i> |
| Flowers dull purple | 2. <i>C. barbellata.</i> |
| Leaves pinnate or bipinnate or sometimes ternate; flowers in panicles. | |
| Sepals spreading from the base. | |
| Filaments glabrous. | |
| Flowers 3-5 in. diameter; leaflets usually glabrous and entire | 3. <i>C. Gouriana.</i> |
| Flowers 7-1 in. diameter; leaflets usually toothed and more or less hairy. | |
| Leaflets villous beneath | 4. <i>C. grata.</i> |
| Leaflets downy, thin | 5. <i>C. puberula.</i> |
| Filaments hairy. | |
| Sepals elliptic, obtuse | 6. <i>C. graveolens.</i> |
| Sepals ovate, acuminate | 7. <i>C. orientalis.</i> |
| Sepals erect with recurved tips. | |
| Filaments hairy throughout. | |
| Stem and leaflets glabrous. | |
| Leaflets 3; sepals glabrous except the margins | 8. <i>C. acuminata.</i> |
| Leaflets 3-7; sepals tomentose within | 9. <i>C. connata.</i> |
| Stem and leaflets hairy | 10. <i>C. Buchananiana.</i> |
| Filaments hairy only in the lower half | 11. <i>C. nutans.</i> |

1. *CLEMATIS MONTANA*, *Buch-Ham. ex DC. Syst. I* (1818) p. 164.—Stem thick, up to 3 inches diameter, twigs terete. Leaves mostly fascicled on arrested branches, trifoliate; petiole 1·5-3 inches long. Leaflets 1-3 inches long, ovate or ovate-lanceolate, acuminate, toothed, membranous, glabrescent. Flowers 2-3 inches across, white, on axillary fascicled peduncles usually longer than the leaves. Sepals spreading, 1-2 inches long, oblong, glabrous or silky outside, tips rounded. Filaments glabrous; anthers ·15 inch long. Achenes glabrous; styles exceeding 1 inch.

Himalaya 7-9,000 feet from the Indus eastwards, common and conspicuous when in flower. Flowers: April—May.

2. *CLEMATIS BARBELLATA*, *Edgew. in Trans. Linn. Soc. XX* (1846) p. 25.—Stems rather thin; twigs terete, dark purplish-brown. Leaves mostly fascicled on arrested branches, trifoliate; petiole 1·5-3 inches long. Leaflets 1·5-4 inches long, ovate or ovate-lanceolate, acuminate, more or less coarsely toothed or often incised, membranous, glabrescent. Flowers 1·5-2 inches across, dull-purple, on axillary fascicled peduncles 1·5-3 inches long. Sepals spreading, ·6-1 inch long, oblong, acuminate, pubescent on both sides, margins villous. Filaments usually fringed with long hair; anthers ·1 inch long, densely bearded on the back. Achenes hairy on the edges and towards the top, otherwise glabrous; styles 1·5-2 inches long.

Himalaya 5-12,000 feet from the Ravi eastwards. In shady places. This plant is probably not distinct from *C. japonica*, Thunb. Flowers: May—June.

3. *CLEMATIS GOURIANA*, *Roxb. Hort. Beng.* (1814) p. 43.—Stems thick, twigs striate. Leaves pinnate, bipinnate or biterminate, usually 6-10 inches long. Leaflets 2-3·5 inches long, ovate, oblong or lanceolate, acuminate, entire or distantly toothed, base cordate or rounded, thin but firm, glabrous or pubescent on the nerves beneath. Flowers ·3-·5 inch across, greenish-white, in dense axillary and terminal panicles. Sepals spreading, ·2-·3 inch long, oblong or obovate, revolute, puberulous, edges tomentose. Filaments glabrous anthers ·05 inch long. Achenes hairy; styles 1-1·5 inches long.

Sub-Himalayan tract from the Rawalpindi District eastwards ascending to 4,000 feet. Salt Range, Hoshiarpur, Chamba. Flowers: August—September.

4. *CLEMATIS GRATA*, *Wall. Cat.* (1828) No. 4668.—Stems rather slender, twigs furrowed. Leaves pinnate, or a few bipinnate or trifoliate. Leaflets usually 5, 1·5-3 inches long, broadly ovate, acuminate, base rounded or cordate, inciso-serrate, more or less deeply 3-lobed or -partite, villous on both sides or

glabrate above. Flowers .6-.8 inch across, cream-colored, fragrant, in many-flowered panicles which often exceed the leaves. Sepals spreading, .25-.35 inch long, ovate-oblong, tomentose outside. Filaments glabrous; anthers .05 inch long. Achenes densely pubescent; styles 1-1.5 inches long.

Himalaya 2-8,000 feet, Trans-Indus to Kumaon. In open shrubby places; common in Hazara and Rawalpindi. Flowers: August-September.

5. *CLEMATIS PUBERULA*, Hook. f. & Thoms. in *Fl. Brit. Ind.* I (1872) p. 4.—Stems moderately thick, twigs grooved. Leaves pinnate. Leaflets 1-1.5 inches long, ovate-lanceolate, entire or remotely toothed, often 3-lobed or -sect, acuminate, membranous, sparsely pubescent. Flowers 1 inch across, yellow, 3-9 in a lax leafy panicle. Sepals spreading, .5 inch long, narrow-oblong, acute, silky-pubescent outside. Filaments glabrous; anthers .05 inch long, elliptic-oblong. Achenes silky.

Himalaya 2-7,000 feet from Simla eastwards. Not common. Probably not specifically distinct from *C. parviloba*, Gardn. and Champ. of China. Flowers: August.

6. *CLEMATIS GRAVEOLENS*, Lindl. in *Journ. Hort. Soc.* I (1846) p. 307.—Stems slender, twigs striate. Leaves pinnately decompose. Leaflets .5-1 inch long, toothed or incised or 3-lobed or -partite, terminal segment oblong, acute or obtuse, glabrous. Flowers 1.5-2 inches diameter, pale-yellow, with a heavy odor, in 3-7-flowered panicles or the upper solitary with a pair of pinnate leafy bracts on the peduncle. Sepals spreading, .7-1 inch long, elliptic, obtuse, pubescent without, densely tomentose within. Filaments hairy; anthers .1 inch long. Achenes pubescent.

Himalaya 6-11,000 feet from the Indus eastwards. Salt Range. In open sunny places; common in Hazara. Flowers: September. Some forms pass into the following species.

7. *CLEMATIS ORIENTALIS*, Linn. *Sp. Pl.* (1753) p. 543.—Stems stout, twigs striate. Leaves pinnate or bipinnate. Leaflets very variable, 1-2 inches long, from orbicular to lanceolate, entire, toothed or cut, glabrous, glaucous. Flowers 1.5 inches diameter, yellow or mottled with purple, in many-flowered panicles. Sepals spreading, .7 inch long, ovate-acuminate, villous without or on both surfaces, edges tomentose. Filaments hairy; anthers .1-.15 inch long. Achenes silky.

Dry inner valleys of the Himalaya from the Indus eastwards ascending to 14,000 feet. Lahaul, Kunawar; common. Flowers: July-August.

8. *CLEMATIS ACUMINATA*, DC. *Syst.* I (1818) p. 148.—Stems slender, woody, twigs striate. Leaves ternate. Leaflets 2-5 inches long, ovate or ovate-lanceolate, long-acuminate, base rounded or subcordate, teeth small distant apiculate or subentire, glabrous. Flowers pale-yellow, in many-flowered

panicles. Sepals erect with recurved tips, .5 inch long, glabrous except for the tomentose margins, oblong, subacute, not ribbed. Filaments with long spreading hairs; anthers .1 inch long. Achenes silky; styles 1 inch long.

Himalaya 5,000-7,000 feet from Simla eastwards. This is *C. acuminata* var. *sikkimensis* of the Fl. Brit. Ind. Flowers: September.

9. *CLEMATIS CONNATA*, DC. *Prodr.* I (1824) p. 4.—Stems stout, twigs faintly grooved. Leaves pinnate, petioles more or less connate sometimes forming a broad flat expansion. Leaflets 3-7, distant, 2-6 inches long, broadly ovate-cordate, coarsely serrate, the teeth apiculate, sometimes lobed, membranous, glabrous. Flowers yellowish-white, in many-flowered panicles. Sepals erect with recurved tips, .7-1 inch long, oblong, subacute, pubescent without, tomentose within, not ribbed. Filaments hairy; anthers .15-.2 inch long. Achenes silky; styles 1.5-2 inches long.

Himalaya 4-10,000 feet from the Indus eastwards; common.* Flowers: July—September.

10. *CLEMATIS BUCHANANIANA*, DC. *Syst.* I (1818) p. 140.—Stems thick, twigs grooved. Leaves pinnate; petioles more or less connate. Leaflets 5-7, 2-4 inches long, broadly ovate or suborbicular, cordate, coarsely serrate, the teeth apiculate, often lobed, slightly pubescent or tomentose beneath. Flowers pale-yellow, fragrant, in many-flowered panicles. Sepals erect with recurved tips, .7-1.2 inches long, linear-oblong, ribbed, tomentose on both sides. Filaments hairy; anthers .15 inch long. Achenes densely hairy; styles 2 inches long. Collett, Fl. Siml., fig. 1.

Himalaya 5-10,000 feet from Dalhousie eastwards. Closely allied to *C. connata* but usually easily recognised by its hairy twigs and leaves. A form with the stems and leaves only slightly pubescent and the sepals scarcely ribbed, is intermediate between the two species, it is found as far west as the Murree Hills. Flowers: August—November.

11. *CLEMATIS NUTANS*, Royle, *Illustr. Bot. Himal.* (1839) p. 51.—Stem slender, twigs grooved, silky. Leaves pinnately decomposed. Leaflets 1-3 inches long, ovate or lanceolate, undivided or 3-5-lobed, irregularly toothed, rarely entire. Flowers pale-yellow, drooping, in leafy panicles. Sepals erect with recurved tips, .7-1 inch long, oblong, densely silky outside. Filaments hairy only in the lower half; anthers .12-.15 inch long. Achenes densely hairy; style 1-1.5 inches long.

Sub-Himalayan tract ascending to 5,000 feet from the Ravi eastwards. "The leaves are very pungent to the taste and produce violent sneezing if smelt after bruising" (Kanjilal). Flowers: September—October.

PARONIA EMODI, Wall.—A glabrous perennial herb. Leaves once or twice ternatisect. Flowers white, 3-4 inches across. Common in moist forest undergrowth especially near Thandiani, Hazara, 5-10,000 feet. Flowers: May—June.

II. MAGNOLIACEÆ.

Trees or shrubs, sometimes climbing. Leaves alternate, usually stipulate. Flowers usually showy and solitary, terminal or axillary. Sepals and petals hypogynous, very deciduous, imbricate, arranged in whorls of three. Stamens numerous, hypogynous; anther-cells adnate, dehiscing longitudinally. Carpels numerous, free or partly cohering, arranged in one or more whorls on an elongated axis; ovules 2 or more in each carpel; styles usually short. Fruit of berried or follicular carpels, the carpels sometimes woody and arranged in a cone. **DISTRIB.** Tropical and temperate Asiatic mountains, North America and a few in Australia and South America.

SCHIZANDRA, Michaux.

(From the Greek, *schizein*, to split, and *aner*, *andros*, a man; referring to the separated anther-cells. **DISTRIB.** Species about 6; India, Java, China and North America.)

SCHIZANDRA GRANDIFLORA, Hook. f. & Thoms. in Fl. Brit. Ind. I (1872) p. 44.—A deciduous climbing shrub with dark-brown smooth bark and short leaf-bearing branches at the nodes. Leaves 3-6 inches long, elliptic-ovate to oblong-lanceolate, acuminate, entire or with small distant glandular teeth, rather soft and fleshy, shining above, pale beneath; petiole .5-1 inch long; stipules 0. Flowers about 1 inch across, waxy-white often tinged with pink, diœcious, fragrant, on drooping axillary peduncles 1-2 inches long. Sepals and petals 9, similar, ovate, concave, the outer smaller. Stamens about 40, small, crowded on an ovoid fleshy column. Filaments thick, connate below; anther-cells separated. Female flowers rather larger and on longer peduncles than the males and the outer perianth segments more highly colored. Carpels numerous, distinct, minute, densely crowded on an oblong fleshy column; ovules 2 in each carpel; stigma sessile. Fruit a slender spike 6-9 inches long, of sessile globose 2-seeded red berries .3 inch diameter. Seeds connate, testa crustaceous. Collett, Fl. Siml., fig. 6.

Himalaya 6-10,000 feet from the Beas eastwards; fairly common in moist shady places. Flowers: May—June.

MICHELIA CHAMPACA, Linn.—A large evergreen tree. Leaves 7-10 by 2-3.5 inches, lanceolate or oblong-lanceolate. Flowers 2-2.5 inches across, yellow or orange, enclosed in bud in a pubescent spathaceous deciduous bract. Sepals and petals 15-21, the outer oblong, the inner linear. Fruit a spike 3-4 inches long, of coriaceous, carpels. Vern. *Champa*.

Indigenous to the Western Ghats, Sikkim and Lower Burma. Cultivated in gardens in the plains and in the Sub-Himalayan tract especially near Hindu temples. In the plains it requires a moist cool situation. Flowers: April—May.

MAGNOLIA GRANDIFLORA, Linn.—An evergreen tree. Leaves 5-8 by 2-3 inches, elliptic-oblong, coriaceous, shining above, more or less rusty-tomentose beneath. Flowers 6 inches or more across, white, enclosed in bud in a silky spathaceous bract. Sepals and petals 9-15. Fruit a woody cone, after dehiscence the bright red seeds remain suspended outside the carpels at the end of long cords consisting of unrolled spiral vessels.

Indigenous to wet situations in the Southern United States. Cultivated in the plains and at Abbottabad. Likes a moist situation and flowers freely in May.

LIRIODENDRON TULIPIFERA, Linn.—A large deciduous tree. Leaves 5-6 inches long and broad, 4-lobed, the apex with a broad shallow sinus dividing the upper pair of lobes or almost truncate. Flowers greenish, 2 inches across. Sepals and petals 9. Fruit a narrow cone. *Tulip-tree*.

Indigenous to the United States. Has been introduced in Simla and is growing well.

III. DILLENIACEÆ.

This family resembles the Magnoliaceæ but has the sepals and petals in fives and the former persistent. It is represented by the following introduced plant :—

DILLENIA INDICA, Linn.—A large evergreen tree, in dry places nearly leafless for a short time. Leaves mostly towards the ends of the branches, 8-12 inches long, oblanceolate or oblong-lanceolate, sharply serrate, lateral nerves very numerous, prominent, parallel; petioles 1-2 inches long, sheathing. Flowers 6-8 inches across, white, solitary, fragrant. Sepals orbicular, concave, thick, fleshy. Stamens many, the inner larger and arching over the outer. Carpels 16-20, cohering at the axis; styles radiating. Fruit 3-5 inches diameter consisting of the thickened closely imbricating sepals which enclose the carpels. Seeds many, in gelatinous pulp.

Indigenous to the Sub-Himalayan tract from Nepal eastwards. Cultivated in the Punjab as far west as Amritsar. This tree loses its leaves in the beginning of the rainy season, the fresh leaves appearing immediately after and the flowers towards the end of the rains.

IV. ANONACEÆ.

Trees or shrubs, erect or climbing. Leaves alternate, entire, exstipulate. Flowers bisexual, rarely unisexual, often extra-axillary. Sepals 3, rarely 2, free or united, usually valvate. Petals usually 6, biseriate, usually thick and fleshy, valvate or slightly imbricate. Stamens usually numerous; filaments short or 0; anther-cells adnate to the outside of a broad usually produced connective. Ovaries 1 or more, apocarpous, rarely (*Anona*) syncarpous; ovules 1 or more; styles short or almost 0. Fruit of 1 or more, sessile or stalked, 1- or many-seeded, usually indehiscent carpels. Seeds large, albumen copious ruminant, embryo minute. *DISTRIB.* A family mainly of the tropics of the Old World.

MILIUSA, Leschen.

(Named after J. Milius Vottolinos of the 16th Century, author of *De Hortorum Cultura*. Species 8; all Indian.)

MILIUSA VELUTINA, Hook. f. & Thoms. Fl. Ind. (1855) p. 151.—A medium-sized or small deciduous tree, bark rough, dark-grey, twigs tomentose. Leaves variable in size, 3-10 by 2-6 inches, ovate or ovate-oblong, acute or acuminate, entire, aromatic, softly tomentose on both sides, base rounded or slightly cordate; petiole .1-.2 inch long. Flowers .5-.7 inch across, pale-yellow, in lax 3-6-flowered leaf-opposed cymes. Pedicels 2-4 inches long, villous. Sepals 3, .1-.2 inch long, ovate, valvate, densely tomentose outside, glabrous within. Petals 6, the 3 outer similar to the sepals, the 3 inner larger, .4-.5, inch long, ovate, densely tomentose outside, glabrous and ultimately black within. Stamens numerous, less than .1 inch long; filaments very short; connectives scarcely produced. Carpels numerous, villous; ovules 2. Fruit of a number of black ellipsoid, stipitate carpels, .6 inch long, edible; stipe .3 inch long, woody. Vern. *Dôm sâl*.

Sub-Himalayan tract near the Jumna. Flowers: March to May, with the young foliage. The tree stands a great deal of shade. I have seen no specimens from the Punjab.

ANONA SQUAMOSA, Linn. An evergreen shrub or small tree. Leaves 1.5-4 by .7-2 inches, elliptic or oblong-lanceolate, pellucid-punctate, glaucous beneath. Flowers .7-1.2 inches long, yellowish-green. Sepals 3, minute. Petals 6, the 3 outer narrowly oblong, the 3 inner minute or wanting. Fruit 2-4 inches diameter, globose, yellowish-green when ripe, marked externally with 5-6-angled areoles. *Custard-apple*. Vern. *Sitaphal*.

Indigenous to Tropical America. Cultivated in the Punjab for its fruits as far west as Gurdaspur.

POLYALTHIA LONGIFOLIA Benth. and Hook. f.—A large evergreen tree. Leaves 3-9 by .7-1.5 inches, lanceolate, tapering to a fine point, shining, glabrous, margins undulate. Flowers 1-1.5 inches across, yellowish-green, in fascicles or shortly pedunculate umbels. Sepals 3. Petals 6, sub-equal, lanceolate, acuminate. Ripe carpels .7 inch long, ovoid, on stalks .5 inch long.

Indigenous to Ceylon. Cultivated in gardens as far west as Amritsar.

ARTABOTRYS ODORATISSIMUS, R. Br.—A large evergreen shrub, often scandent. Leaves 3-7 by 1-2 inches, oblong-lanceolate, shortly acuminate, glabrous, shining. Flowers 1.2-1.5 inches long, yellowish, solitary or paired, highly fragrant. Sepals 3, small. Petals, 6, the bases concave and connivent over the genitalia, limb spreading. Fruit of many obovoid glabrous carpels, yellow when ripe, 1.5-2 inches long, aromatic, stipitate.

Indigenous to Tenasserim, Ceylon and China. Often cultivated in gardens for its intensely fragrant flowers. Usually grown as a large dense bushy shrub but the long arching branches become scandent if they can reach a support. The seeds take about 12 months to germinate. Flowers: April-September.

V. MENISPERMACEÆ.

Climbing, rarely erect shrubs or small trees. Leaves alternate, entire or lobed, usually palmi-nerved, often peltate; stipules 0. Flowers small, dioecious or polygamous. Sepals

usually 6, in two series, the outer often minute, imbricate. Petals usually 6, in two series. Stamens usually as many as and opposite to the petals; filaments free or united in a column; reduced to staminodes or wanting in female flowers. Carpels distinct, 3 or more or 1 only; ovule 1 in each carpel. Fruit drupaceous; style-scar sub-terminal or sub-basal. Seed usually hooked or reniform, often horseshoe-shaped. **DISTRIB.** Chiefly in the Tropics of both hemispheres.

Stamens free. Ovaries 3.

Leaves not peltate, rarely cordate; drupe with a sub-basal style-scar ... 1. *Cocculus*.

Leaves cordate; drupe with a sub-terminal style-scar ... 2. *Tinospora*.

Stamens united in a column. Ovary 1.

Glabrous; flowers umbellate ... 3. *Stephania*.

Pubescent or tomentose; flowers cymose or clustered in the axils of orbicular bracts 4. *Cissampelos*.

1. COCCULUS, DC.

(From the Greek *kokkos*, a berry; the fruit is however not a berry but a drupe.)

Climbing shrubs, rarely erect shrubs or a small tree. Leaves ovate to linear. Flowers in axillary, usually short panicles. Sepals 6, in two series, the inner larger. Petals 6, shorter than the sepals, usually auricled. Stamens embraced by the petals, anther-cells dehiscing transversely. Ovaries 3; style usually cylindric. Drupes laterally compressed; style-scar near the base; endocarp horseshoe-shaped, dorsally keeled and tuberculate, the sides excavate. **DISTRIB.** Species about 30; all warm regions.

An erect shrub or small tree ... 1. *C. laurifolius*.

Climbing shrubs.

Tomentose or hairy; male flowers in axillary panicles ... 2. *C. villosus*.

Glabrous except when young; male flowers in sessile axillary clusters ... 3. *C. Leæba*.

1. COCCULUS LAURIFOLIUS, DC. *Prodr.* I (1824) p. 100.—

A large evergreen shrub or small tree with short bole and smooth grey bark; branchlets with tufts of hairs at the base and in the leaf-axils, otherwise glabrous. Leaves 2-5 inches long, lanceolate or elliptic-lanceolate, entire, shining above, paler green and shining beneath, 3-nerved; petiole 1-3 inch long. Flowers minute, yellowish, in axillary panicles shorter than the leaves. Inner sepals suborbicular, concave, about .05 inch long, twice as long as the outer. Petals very minute, 2-lobed. Ovaries sometimes 4; styles reflexed. Drupe .15 inch diameter, black.

Sub-Himalayan tract and outer Himalaya ascending to 5,000 feet. From Chamba and Kangra eastwards. Usually in moist shady places; common in Kangra. Flowers: April—May, faintly fragrant. The wood has an anomalous structure due to the activity of the cambium ceasing, a secondary cambium appearing in the bark which carries on growth in thickness, cutting off wood elements on the inner side but leaving a portion of the bast tissue embedded in the wood in the form of a ring. After a time the activity of this cambium ceases and a fresh cambium is formed in the bark and the process repeated several times so that in old stems the rings of bast tissue resemble annual-rings except that they often anastomose.

2. *COCCULUS VILLOSUS*, DC. *Syst. I* (1818) p. 525.—An extensive climbing shrub; branchlets, leaves and inflorescence grey-tomentose. Leaves variable in size up to 3 by 2 inches, ovate or ovate-oblong, obtuse, sub-acute or retuse, apiculate, base rounded or slightly cordate, softly tomentose on both sides but ultimately nearly glabrous; petioles $\cdot 1\text{--}5$ inch long. Flowers minute, the male in small axillary panicles, the female in axillary clusters of 1-3. Sepals hairy outside, the three inner larger. Petals thin, obovate, emarginate, embracing the stamens; in female flowers larger, fleshy, two-lobed at the apex with hairy claws. Drupe $\cdot 2$ inch diameter, dark-purple.

Along the foot of the Himalaya ascending to 3,000 feet and in the neighboring plains in the East Punjab. Abundant in the Phillaur Plantation. Wood structure similar to that of *C. laurifolius*. Flowers: February-March.

3. *COCCULUS LÆBEA*, DC. *Syst. I* (1818) p. 529.—A climbing shrub, stems up to 6 inches diameter, bark corky, foliage usually very scanty, young portions puberulous. Leaves very variable, $\cdot 5\text{--}1\cdot 5$ inches long, suborbicular to linear-oblong, sometimes lobed, usually obtuse, base truncate, cuneate or rounded, glabrous and glaucous when mature; petiole $\cdot 1\text{--}3$ inch long, hairy. Flowers minute; the male in dense axillary clusters; the female axillary, solitary (rarely paired). Sepals slightly hairy on the outside, the outer smaller and more hairy. Petals deeply and acutely emarginate, the two lateral lobes embracing the stamens; in female flowers not lobed, claws thick, glabrous. Drupe $\cdot 15$ inch diameter, obovoid, compressed, black.

Trans-Indus, Salt Range and throughout the Punjab plains. A common climber on *Capparis aphylla*. Wood structure similar to that of *C. laurifolius*. In flower or fruit throughout the year.

2. TINOSPORA, Miers.

(From *Tinus*, the *Laurustinus*, *Viburnum Tinus* and *spora*, a seed. DIS-TRIB. Species 9; tropical Asia, Africa and Australia.)

TINOSPORA CORDIFOLIA, Miers, in *Ann. & Mag. Nat. Hist. sér. 2*, VII (1851) p. 38.—A large deciduous rather succulent shrub with corky bark. Leaves 2-5 inches long and broad,

cordate, acute or acuminate, when mature glabrous on both sides, glaucescent beneath, base 7-nerved; petiole 1·5-3 inches long. Flowers small, yellow, appearing when the plant is leafless, in slender racemes or racemose panicles which are axillary, terminal or on the old wood; the male fascicled, the female usually solitary. Sepals, the 3 outer very small, ovate-oblong, acute; the 3 inner larger, membranous, suborbicular, concave. Petals 6, wedge-shaped. Stamens 6, filaments free, thickened at the apex; anther-cells dehiscing longitudinally by an oblique slit; reduced to clavate staminodes in female flowers. Ovaries 3; stigmas forked. Drupes 1-3, ovoid, red, ·3 inch long; style-scar terminal. Seed curved.

Punjab (*Fide* Brandis, *Ind. Trees*, p. 700). I have seen no specimens from the Punjab. **DISTRIB.** United Provinces, Rajputana. Long filiform aerial roots are developed from the stem and branches. Flowers in the hot and rainy seasons. Sometimes cultivated in Lahore.

3. STEPHANIA, Lour.

(From the Greek, *stephanos*, a crown; referring to the ring of anthers at the top of the staminal column.)

Glabrous climbing shrubs. Leaves peltate, orbicular or sub-triangular, basal nerves numerous. Flowers small, in compound pedunculate umbellate cymes. Male flowers; sepals 6-10, free, 2-seriate. Petals 3-5, shorter than the sepals, obovate, fleshy. Anthers 6, connate into a ring round the top of the staminal-column; cells dehiscing transversely. Female flowers; sepals 3-5. Petals as in the male. Staminodes 0. Ovary 1; style 3-6-partite. Drupe glabrous; endocarp compressed, horseshoe-shaped, dorsally tubercled, sides hollow and perforate. **DISTRIB.** Species 4; Tropical Africa, Asia, Australia and Polynesia.

Leaves triangular; flowers purple	...	...	1. <i>S. elegans</i> .
Leaves orbicular; flowers yellow	...	...	2. <i>S. glabra</i> .

1. STEPHANIA ELEGANS, *Hook. f. & Thoms. Fl. Ind.* I (1855) p. 195.—Twigs slender, striate. Leaves variable in size, 2·5-4 by 1-2·5 inches, triangular-ovate, acuminate, entire, thin, pale beneath, 8-nerved, peltate; petiole 1-2 inches long, slender. Umbels axillary, solitary, lax, long-peduncled, many-rayed or several in a long-stalked cyme. Flowers ·1 inch diameter, red-purple. Sepals obovate, acuminate. Petals obovate. Drupes ·3 inch long, red, endocarp with about 10 transverse ridges.

Outer Himalaya ascending to 6,000 feet from Kangra eastwards; not common. Flowers: September.

2. STEPHANIA GLABRA, *Miers, in Ann. & Mag. Nat. Hist.* 3, sér. XVIII (1866) 14 n. n.—Root bulbous. Twigs ribbed. Leaves 3-7 inches diameter, broad-ovate or orbicular, often sinuate thin, pale beneath, 11-nerved, peltate; petiole 3-9

inches long. Umbels axillary, peduncle 1·5-3 inches long, rays about 6. Flowers ·2 inch diameter, yellowish-green. Sepals, the three outer linear-oblong, the three inner spatulate. Petals shorter and broader than the sepals. Drupes pisiform, red, endocarp with 15 or more transverse ridges. *S. rotunda*, Hook. f. et Thoms. ex parte.

Outer Himalaya ascending to 6,000 feet from the Sutlej eastwards; not common. Flowers: June—August.

4. CISSAMPELOS, Linn.

(From the Greek, *kissos*, ivy, and *ampelos*, a vine; referring to the climbing habit. **DISTRIB.** Species 18; all hot regions.)

CISSAMPELOS PAREIRA, Linn. *Sp. Pl.* (1753) p. 1031.—A softly pubescent or tomentose shrub, twigs striate. Leaves 1-4 inches diameter, orbicular or reniform, base cordate or truncate, usually obtuse, mucronate, pubescent or tomentose on both sides but ultimately glabrous, peltate; petiole 1·5-4 inches long, pubescent. Flowers minute, yellowish. Male flowers in pedunculate branched cymes clustered in the leaf-axils or on long axillary shoots with small leaves and small axillary cymes; pedicels filiform. Sepals 4, obovate-oblong, concave, hairy outside. Petals united into a shallow 4-lobed cup, hairy outside, less than half as long as the sepals. Stamens 4; filaments united into a very short column; anthers connate, encircling the top of the column; cells dehiscing transversely. Female flowers clustered in the axils of orbicular bracts arranged in long axillary dense racemes. Sepal 1, ovate-oblong, villous outside. Petal 1, subrotund, about half as long as the sepal. Ovary 1, hairy; style short, 3-fid. Drupes ·2 inch diameter, globose, compressed, hairy, scarlet; endocarp transversely ridged, horseshoe-shaped. Collett, Fl. Siml., fig. 7.

Along the foot of the Himalaya from the Indus eastwards, ascending to 6,000 feet and extending out into the neighboring plains. Common in hedges and grassy places. Flowers: May—August.

VI. BERBERIDACEÆ.

Shrubs, erect or climbing or glabrous herbs. Leaves alternate often crowded on dwarf shoots, simple or compound. Flowers regular, usually yellow or white. Sepals and petals free, usually trimerous and biseriate. Stamens 4-6, opposite the petals; anthers adnate, dehiscing by slits, or by 2 ascending valves. Carpels 1-3. Fruit usually a berry. **DISTRIB.** A small family mainly in temperate and mountainous regions.

Erect shrubs.

Leaves simple	...	...	...	1. <i>Berberis</i> .
Leaves pinnate	...	...	...	2. <i>Mahonia</i> .
Climbing shrubs	...	...	...	3. <i>Holboellia</i> .

1. BERBERIS, Linn. (The Barberries).

(From the Arabic name.)

Spiny shrubs with yellow wood. Leaves alternate or clustered on dwarf shoots in the axil of a 1-3-5-branched spine, simple, entire or more often spiny-toothed, sometimes lobed. Flowers small, yellow, solitary, fascicled or in bracteate simple or compound racemes. Sepals 3 plus 3, petal-like, imbricate, the outer smaller. Petals 3 plus 3, imbricate, usually shorter than the sepals, 2-glandular at the base. Stamens 6, dehiscing by ascending valves. Carpel 1. Ovules 1-12, basal anatropous. Fruit a berry, blue or red.

Over 160 species have been described and the number is constantly being added to; temperate and mountainous regions excepting South and Central Africa and Australasia. The species are variable, closely allied and difficult to keep apart. The genus has been critically examined by C. K. Schneider from herbarium materials and his results published in the Bulletin de L'Herbier Boissier, 1905 & 1908.

The vernacular names like the English name Barberry are used for all species indiscriminately. Vern. *Sumbal*, *Sumblu* (Haz. & Rp.), *Kiamal* (Ch), *Kasmal* (Ka), *Kashambal* (Ku).

A.--Fruits, red.

I. Inflorescence a simple raceme.

- | | | | |
|------------------------------------|-----|----|--------------------------|
| Lower pedicels 4 in. long... | ... | 1. | <i>B. pachyacantha</i> . |
| Lower pedicels scarcely 2 in. long | ... | 2. | <i>B. Zabeliana</i> . |

II. Inflorescence paniculate.

- | | | | |
|---|-----|----|---------------------------|
| A large shrub, twigs and panicle-branches red | ... | 3. | <i>B. Chitria</i> . |
| Dwarf shrubs, twigs not markedly red. | | | |
| Inflorescence and twigs pubescent | ... | 4. | <i>B. kunawurensis</i> . |
| Inflorescence and twigs glabrous | ... | 5. | <i>B. Edgeworthiana</i> . |

III. Inflorescence subcorymbosely 3-5-flowered 6. *B. Jaeschkeana*.

B—Fruits, blue.

- | | | | |
|---|-----|----|-----------------------|
| Leaves lanceolate or narrowly obovate-oblong, subsessile; flowers racemose, pedicels slender | ... | 7. | <i>B. Lycium</i> . |
| Leaves obovate or elliptic, strongly reticulate, subsessile; flowers racemose, pedicels stout | ... | 8. | <i>B. aristata</i> . |
| Leaves obovate-lanceolate or spatulate, petiolate; flowers subumbellate | ... | 9. | <i>B. umbellata</i> . |

1. BERBERIS PACHYACANTHA, Koehne, Deutsche Dendrol. (1893) p. 170.—Deciduous, 8-10 feet high, twigs glabrous, spines usually simple, often wanting. Leaves 1-4 by .6-1.5 inches, ovate, obovate or oblong or oblong-lanceolate, thin, membranous, closely but rather irregularly toothed or entire, narrowed towards the base; petiole distinct up to .5 inch long. Racemes simple, lax, glabrous, exceeding the leaves, pendulous. Lower

pedicels .4 inch long. Fruit oblong-ovoid, red, .3-.4 inch long; style very short; stigma large. *B. vulgaris*, var. 1. *vulgaris* proper, Fl. Brit. Ind., I, p. 109.

Himalaya 6-12,000 feet; common in moist shady places. Flowers: April—June.

2. *BERBERIS ZABELIANA*, C. K. Schn. in *Bull. Herb. Boiss. sér. II* (1905) p. 667.—Deciduous, 3 feet high, twigs glabrous, rigid, spines 1-5-, usually 3-branched. Leaves 2 inches long, lanceolate to obovate, closely but rather irregularly toothed, reticulate, margins slightly thickened; petiole distinct, very short. Racemes simple, glabrous, stiff, about as long as the leaves. Lower pedicels scarcely .2 inch long. Fruit ovoid, red, .3 inch long; style very short; stigma large.

Upper Kagan Valley, Battakundi, 9,000 feet. Gregarious in dense patches in open dry places. **DISTRIB.** Kashmir. According to Schneider this differs from the above in having horizontal fruiting racemes, fruits with shorter stalks, leaves more reticulate, relatively smaller and more pointed with longer and more numerous teeth. I doubt if it can be maintained as a distinct species and the differences are perhaps only due to the dryer climate in which it is found.

3. *BERBERIS CHITRIA*, Lindl. in *Bot. Reg.* (1823) t. 729.—Almost deciduous, 8-10 feet high, twigs red or dark reddish-brown, finely pubescent, spines usually simple towards the ends of flowering shoots. Leaves up to 2.5 by 1 inch, obovate, with distant small spinous teeth or up to 2 inches by .5 inch, lanceolate and entire, firm, minutely lacunose above, petiole short. Panicles up to 4 inches long, usually unbranched in the lower half, peduncle slender, glabrous, red, branches and pedicels red. Flowers often tinged with red. Fruit oblong-ovoid, narrowed at both ends, .4-.5 inch long, red; style distinct. *B. aristata*, var. 1. *aristata*. Fl. Brit. Ind., I, p. 110. Collett, Fl. Siml., fig. 8.

Himalaya from Kulu eastwards. Common in Simla and the Pabar Valley. Bashahr, 6-9,000 feet. A shrub of open places and fairly dry forest undergrowth. Flowers: May—June.

4. *BERBERIS KUNAWURENSIS*, Royle, *Ill. Bot. Himal.* (1839) p. 64.—Deciduous, 3 feet high or less, twigs brownish, sulcate, minutely pubescent, spines slender, usually 3-fid. Leaves up to 1.2 by .4 inch, lanceolate or oblanceolate, toothed, membranous, nearly sessile. Panicles equalling or scarcely exceeding the leaves, pubescent, dense-flowered. Fruit ovoid, red, .3 inch long; style 0. *B. vulgaris*, var. *atnensis*. Fl. Brit. Ind. I, p. 109.

Himalaya 7,000-10,000 feet, common along the Miranjani Ridge in Hazara, also in Kagan. Flowers: June. Usually in dense patches in exposed situations. **DISTRIB.** Kashmir. I have followed Schneider in referring

this plant to *B. kunawurensis*, Royle, though it is probable that Royle's plant is the following as I have seen no specimens of *B. kunawurensis* from Kunawar or even Chamba.

5. *BERBERIS EDGEWORTHIANA*, C. K. Schn. in *Bull. Herb. Boiss. sér. II* (1908) p. 263.—A somewhat larger shrub than the above, twigs pale-grey or yellowish, glabrous. Leaves up to 1·5 by ·6 inch. Panicles usually slightly exceeding the leaves, branches and pedicels glabrous (bracts minutely pubescent). *B. brachybotrys*, Edgew. *B. vulgaris*, var. *brachybotrys*. Fl. Brit. Ind., I, p. 109.

Himalaya 8-12,000 feet, from Chamba to Garhwal; Kulu, Kunawar and Simla Hills. *Vide* the remarks under *B. kunawurensis* of which this plant seems to be a local form. Flowers: June–July.

6. *BERBERIS JÆSCHKEANA*, C. K. Schn. in *Bull. Herb. Boiss. sér. II* (1905) p. 399.—Deciduous, up to 4 feet high, twigs minutely pubescent or nearly glabrous, yellowish-brown or yellowish-red, spines 3-(5-) fid. Leaves up to 1 by ·35 inch, lanceolate or oblanceolate, spinous-toothed, rarely entire, membranous, paler beneath, nearly sessile. Inflorescence subcorymbosely 3-5-flowered, flowers nodding, common peduncle ·6 inch long or often scarcely produced, pedicels ·2-·3 inch long. Stamens tipped by the shortly produced connective. Fruit ovoid, ·5 inch long, red with no style, pedicels curved.

Himalaya 9-13,500 feet; Kagan, Lahaul and Kunawar; not common. Flowers: June–July. *DISTRIB.* Kashmir to Kumaon. *B. garhwalensis*, C. K. Schn., apparently belongs here,—*vide* the remarks under *B. umbellata*.

7. *BERBERIS LYCIUM*, Royle, in *Trans. Linn. Soc. XVII* (1837) p. 94.—Semi-deciduous, 6-8 feet high, twigs yellowish, glabrous or minutely pubescent. Leaves 1-3 by ·3-·7 inch, lanceolate or narrowly obovate-oblong, coriaceous, entire or with a few large spinous teeth, dull green above, pale and glaucous beneath, narrowed into a short petiole. Racemes drooping, longer than the leaves, often with a few long-stalked flowers at the base; pedicels slender, ·5 inch long. Berries ovoid, ·3 inch long, blue, style distinct.

Himalaya 3-7,000 feet; common. Flowers: March–June. A form of this plant has been described as *B. Parkeriana*, C. K. Schn, in *Fedde Rep. Sp. Nov.*, XI (1912), p. 162. It differs mainly in anatomical characters, the leaves not being papillose beneath, though those which persist over the winter become pale and glaucous. The racemes are also slightly shorter and the twigs paler and more angular. This plant ascends to 9,000 feet in Hazara, and replaces *B. Lycium* as understood by Schneider in Rawalpindi and Hazara. This species as well as others is used for making *rasaunt*, a brown extract prepared from the root and lower stemwood by boiling in water. The extract is worth from 18-30 rupees a maund, the chief market being Amritsar. It is used for mixing with drinking water and medicinally for eye-complaints. *Vide* Lovegrove, Indian Forester, May 1914. The industry brings in a considerable revenue in Kashmir but has not been established in the Punjab. It would be

worth developing where *Berberis* is common in forest undergrowth as apart from the revenue the removal of the *Berberis* would often be advantageous but in many places where *Berberis* is found on steep open hillsides the removal of the roots would be followed by denudation of the soil and could not be permitted.

8. *BERBERIS ARISTATA*, DC. *Syst.* II (1821) p. 8.—Deciduous, 8-18 feet high, twigs round, glabrous, pale yellowish, with small dark specks, spines occasionally simple. Leaves 1.5-3 by .6-1.2 inches, obovate or elliptic, rather coriaceous, strongly reticulate, deep green and lacunose above, paler beneath but not glaucous, margins thickened, entire or spinous-toothed, narrowed into a very short petiole. Racemes simple, about as long as the leaves; pedicels stout, .2-.3 inch long. Fruit blue, densely glaucous, .3 inch long, globose; style distinct. *B. aristata*, var. *floribunda*. Fl. Brit. Ind., I, p. 110. *B. coriaria*, Royle.

Himalaya 6-10,000 feet from Chota Banghal to Nepal; not common west of the Sutlej. In open shrubby places. The young fruits are white resembling bunches of white currants. Flowers: April—May.

9. *BERBERIS UMBELLATA*, Wall. *Cat.* (1828) No. 1475.—Deciduous, 6-8 feet high, twigs slender, somewhat angular, reddish-brown or purplish, glaucous, rough with numerous small raised lenticels, spines 1-3-fid. Leaves about 1 inch long, obovate-lanceolate or spathulate, membranous, entire or spinous-serate, usually whitish beneath when mature; petiole distinct, .2 inch long. Racemes subumbellate, 3-10-flowered, peduncle 1 in. or sometimes reduced or almost wanting; pedicels slender. Fruit globose-ovoid, .3 inch long, blue, glaucous; style 0; stigma large.

Himalaya in the inner dry valleys 4-9,000 feet. Flowers: April—May. Kagan, Jared to Narhan; Kunawar, common in the Baspa valley.

The above description does not cover specimens from Garhwal and Kumaon which have stouter twigs, usually not red, subsessile oblanceolate (not spathulate) leaves. This form, which has also been collected in Kunawar, was described as *B. garhwalensis* by C. K. Schneider in Bull. Herb. Boiss. sér. 2 (1905), p. 454, but subsequently Schneider reduced it to *B. umbellata*. Wall. (l. c. (1908), p. 200). The fruit is ovoid-oblong and red. In my opinion *B. garhwalensis*, C. K. Schn., is referable to *B. Jaeschkeana*, C. K. Schn., differing only in vigor. The leaves are sometimes 2 inches long; peduncles .5-.8 inch long and pedicels .3-.6 inch long.

2. *MAHONIA*, Nutt.

(In honor of Bernard McMahon, a botanist of Philadelphia. *DISTRIB.* Species 37; West North America, East and South-East Asia.)

MAHONIA NEPALENSIS, DC. *Syst.* II (1821) p. 21.—An erect evergreen shrub 3-6 feet high, branches stout. Leaves 6-18 inches long, crowded towards the ends of the branches, imparipinnate, rachis jointed at the insertion of the leaflets,

broadly sheathing at the base, bearing at the top of the widened basal portion 2 small subulate spinescent stipules. Leaflets 7-25, the lateral opposite, sessile, the lowest pair much the smallest close above the stipules, the remainder 2-4 inches long, ovate, lanceolate or oblong, acuminate, spinous-serrate, more or less falcate, coriaceous with recurved margins, quite glabrous, dull green or very shiny above, paler beneath. Flowers about .3 inch across, yellow, in dense racemes 2-6 inches long, crowded at the ends of the branches. Pedicels .1-.2 inch long; bracts ovate, persistent, about as long as the pedicels. Sepals 3 plus 3 plus 3. Petals 3 plus 3, with 2 glands on each near the base. Stamens 3 plus 3, dehiscing by ascending valves. Ovary 1-celled; style short; stigma capitate, large. Berries ovoid, .3-.5 inch long, blue, glaucous. *Berberis nepalensis*, Spreng. Fl. Brit. Ind., I, p. 109.

Himalaya 4-8,000 feet. Rare in the Punjab but has been collected by Lace near Dalhousie. Grown in gardens in Abbottabad. Flowers: October—April.

3. HOLBÆLLIA, Wall.

(In honor of Fred. Louis Holboell, a Superintendent of the Botanic Gardens at Copenhagen. DISTRIB. Species 2; India and China.)

HOLBÆLLIA LATIFOLIA, Wall. *Tent. Fl. Nep.* (1824) p. 24, t. 16.—An evergreen climbing shrub, bark corky when old deeply vertically fissured, twigs striate, glabrous, often transformed into tendrils at the tips. Leaves 3-9-foliate, digitate; petiole 2-3 inches long. Leaflets 3-5 by .5-2 inches, elliptic or oblong, acute or acuminate, entire, glabrous, sub-3-nerved at the base, paler beneath, margins slightly recurved; petiolules .5-1 inch long, those of the lateral leaflets shorter than the central, jointed to the petiole and to the blade. Flowers about .5 inch across, purplish, strongly sweet-scented, monœcious, in axillary fascicled few-flowered racemes 1-2.5 inches long. Sepals 6 in two series, .4-.5 inch long, larger in female flowers, oblong, erect in flower, the 3 outer valvate. Petals 6, minute, orbicular. Stamens 6, two-thirds the length of the sepals; filaments broad, flattened; anthers as long as the filament, dehiscing by slits, connective produced beyond the cells; in female flowers reduced to minute staminodes. Carpels 3, free, oblong, glabrous, half as long as the sepals; style 0; stigma oblong. Ovules numerous covering the walls of the ovary. Fruit of 1-3, oblong berries, 2-4 inches long, edible; seeds many, embedded in pulp.

Himalaya 4-9,000 feet from the Indus eastwards. Not common in the Punjab but occurs at many places in Hazara in ravines, e. g., Massar Reserve, Kalapani, Bagnotar. Flowers: April—May.

NANDINA DOMESTICA, *Thunb.*—A shrub about 4 feet high with many erect little-branched stems. Leaves alternate, 12-15 inches long, tripinnate; leaflets 5-2 inches long, usually lanceolate or rhomboid-lanceolate, entire. Flowers 2 inch long, white, in large erect terminal panicles; petals and sepals in numerous whorls increasing in size towards the centre. Carpel 1. Berries red, the size of a pea.

A native of China and Japan often grown in gardens chiefly for its ornamental foliage. Flowers: May.

The following plant yields a drug of some economic importance.

PODOPHYLLUM EMODI, *Wall.*—A glabrous herb 6-12 inches high. Leaves 1-5, peltate, orbicular, 6-10 inches across, 3-5-lobed to the middle, segments sharply toothed. Flowers usually solitary, 1.5 inches across, white. Sepals 3, petaloid, fugacious. Petals 6. Stamens 6. Carpel 1; stigma large, sessile. Fruit an ovoid scarlet berry 1-2 inches long; seeds numerous, embedded in pulp. Vern. *ban-kakri*.

Himalaya 6-12,000 feet from the Indus eastwards. Fairly common in moist forest undergrowth. The portion used is the rhizome and roots which contain a resin used as a purgative, the action being mainly on the liver and causes an increased secretion of bile. The demand for the drug is very large and it is at present obtained mainly from an American species *P. peltatum*. The Indian plant however yields twice as much resin as the American. *Podophyllum* has been regularly collected in Hazara but the supply has seldom exceeded 50 maunds whereas there is a demand for 50 tons at least. The price in 1910 was over Rs. 14 per maund but as the plant occurs in comparatively small quantities scattered over large areas the collection has lately been abandoned. The plant could probably be cultivated profitably. Seed appears to require two years to germinate and the rhizomes from plants known to be 7 years old were only about half the size of those from mature plants. Sections of the rhizome may also be planted, they are said to grow in the second year after planting and to be fit to collect in the fourth or fifth year. The plant appears in April and dies down in November. Flowers: May. Fruit ripens August—September.

VII. CAPPARIDACEÆ.

Herbs, shrubs or trees, erect or climbing. Leaves alternate, simple or digitate, with or without stipules. Flowers very rarely quite regular, usually zygomorphic, bisexual, usually tetramerous. Sepals usually 4, free or connate. Petals usually 4, free, imbricate or open in bud, rarely valvate. Stamens 4 to numerous, usually exserted. Disk 0 or tumid or lining the calyx-tube. Ovary sessile or on a long or short gynophore, 1-celled; ovules numerous on 2-4 parietal placentas. Fruit capsular or baccate, or dry and indehiscent, very rarely drupaceous. **DISTRIB.** Chiefly in tropical regions.

Leaves simple.

Petals clawed; stamens 4-6

... 1. *Cadaba*.

Petals not clawed; stamens numerous.

Unarmed, fruit moniliform

... 2. *Mærua*.

Armed; fruit a berry

... 3. *Capparis*.

Leaves trifoliate

... 4. *Cratæva*.

1. CADABA, Forsk.

(From *khadab*, the Arabic name of *C. rotundifolia*. DISTRIB. Species about 12; dry regions of Western Asia and Tropical Africa.)

CADABA FARINOSA, Forsk. *Fl. Aegypt-Arab.* (1775) p. 68.—An unarmed, straggling, much-branched shrub about 10 feet high; stems terete, the older purplish, smooth, the younger pubescent, yellowish-brown. Leaves 5-1.5 inches long, elliptic-oblong, acute, obtuse or retuse, mucronate, dull-green, mealy when young, glabrous when mature, entire; petiole .1-.2 inch long; stipules minute. Flowers .6 inch across, dirty-white, in few-flowered terminal corymbose racemes. Pedicels .3-.7 inch long, pubescent, mostly turned to one side of the rachis; bracts minute, subulate. Sepals .3-.4 inch long, the two outer boat-shaped, valvate, the two inner flat, ovate, acute, petaloid, all pubescent outside. Petals 4, spatulate, equalling the sepals, claws long, slender. Disk prolonged into a tubular process .3 inch long, mouth oblique, apex toothed. Stamens 4 or 5, inserted about half-way up the gynophore; filaments long. Ovary oblong on a gynophore .7-.9 inch long; style 0. Fruit 1-2 by .1 inch; cylindric, irregularly torulose, glabrous or pubescent. Seeds many, striate, surrounded by an orange-red aril.

Punjab plains in dry places. Changa Manga, Multan, Montgomery. Flowers: November--January. *C. indica*, Lamk., is probably not specifically distinct. The Central India specimens referred to *C. indica* have the limb of the petals slightly broader and are sometimes less mealy. The number of stamens does not suffice to separate the two as flowers with 4 and 5 stamens may be found on the same twig.

2. MÆRUA, Forsk.

(From *meru*, the Arabic name of *M. uniflora*. DISTRIB. Species about 20; Tropical Asia and Africa.)

MÆRUA OVALIFOLIA, Cambess. in Jacq. *Voy. Bot.* (1844) p. 23, t. 24.—A large woody climber; bark smooth, light-grey. Leaves 1-2 inches long, elliptic-oblong, obtuse or retuse, mucronate, dull-green, glaucous, glabrous; petiole .2 inch long; stipules minute. Flowers .8-1.5 inches across, greenish-white, in corymbs terminating the main or short lateral shoots, rarely axillary and solitary. Pedicels .5-.7 inch long, glabrous; bracts minute. Calyx-tube .1-.2 inch long, funnel-shaped; lobes 4, .4-.6 inch long, ovate, acute, hooded at the apex and furnished with a short horn on the back close below the tip, margins tomentose. Disk lining the calyx-tube. Petals 4, smaller than the calyx-lobes, ovate-lanceolate, acute, margins undulate, inserted on the margin of the disk. Stamens many, inserted on the gynophore about level with the top of the calyx-

tube, exserted. Ovary cylindric, truncate, on a gynophore .7-1 inch long; style 0. Fruit up to 3 inches by .5 inch, yellow, constricted between the seeds, forming an elongate twisted and knotted berry, each lobe or knot 1-seeded. Seeds brown, globose, echinate. *M. arenaria*, Hook. f. and Thoms. Fl. Brit. Ind., I, p. 171. Brandis Ind. Trees, fig. 13.

Punjab plains. Changa Manga, Multan, Hissar. Delhi. Flowers: November—March. Two varieties are mentioned in the Fl. Brit. Ind.:—var. *glabra* with the leaves and shoots glabrous; var. *scabra* with the leaves and shoots scabrous and the calyx pubescent. The former is the plant of the Central Punjab, the latter being found at Delhi.

3. CAPPARIS, Linn.

(From *kapparis*, the Greek name for *C. spinosa*, used by Dioscorides.)

Trees or shrubs, erect, decumbent or climbing, usually armed with stipular spines. Leaves simple, rarely wanting; stipules sometimes foliaceous or wanting. Flowers often showy. Sepals 4, in two series, the outer subvalvate or all imbricate, free or connate at the base. Petals 4, imbricate. Disk (in the species of the old world) much reduced. Stamens usually many, inserted at the base of the gynophore. Ovary stalked, usually 1-celled; stigma sessile; ovules many on 2-6 parietal placentas. Berry stalked, globose or cylindric, many-seeded, rarely dehiscent. Seeds embedded in pulp. **DISTRIB.** Species 150; all warm regions except N. America.

Leafless or nearly so	... 1. <i>C. aphylla</i> .
Leafy shrubs.	
Flowers solitary	... 2. <i>C. spinosa</i> .
Flowers umbellate	... 3. <i>C. sepriaria</i> .
Flowers supra-axillary in a vertical line	... 4. <i>C. horrida</i> .

1. CAPPARIS APHYLLA, *Roth, Nov. Pl. Sp.* (1821) p. 238.—A glabrous straggling shrub or small tree, leafless or nearly so, twigs smooth, green, often with a waxy bloom; bark grey, corky rough. Leaves on young shoots only, less than .5 inch long, linear-oblong, acute, spinous-pointed, caducous, sessile or subsessile; stipules .15 inch long, spinous, nearly straight, often wanting. Flowers .8 inch across, red, rarely yellow, in corymbs on short lateral branches; pedicels .5 inch long, slender. Sepals pubescent; the outer subvalvate, the lower very saccate, the upper much smaller, concave; the inner elliptic, acute. Petals narrow-oblong. Stamens .8 inch long. Gynophore .5-.7 inch long. Berry .5-.7 inch diameter, globose, red or pink, on a slender stalk. Vern. *karîl*, *karîr*.

Throughout the dry parts of the Punjab; common. This plant with *Prosopis spicigera* and *Salvadora oleoides* forms the bulk of the "rakh" vegetation. In the hilly country west of the Jhelum and Trans-Indus it is found associated with *Olea cuspidata* and *Monotheca buxifolia* but prefers the flatter places with deep soil. Reproduces more freely than many of the

rakh plants, reproduction being mainly if not almost entirely, by root-suckers. It is the last species to disappear in *rakhs* ruined by cutting and browsing, being little in demand for firewood and giving bad charcoal. The wood is hard and compact and is not eaten by white ants. It is used to some extent for small beams, rafters and posts. As a young plant it forms rounded bushes consisting of the densely interlaced twigs which completely hide the stem but in course of time the lower branches are shed leaving a short clear bole. Stems 8 feet in girth have been recorded but it is usually not more than 4-5 feet in girth with a height of 15-20 feet. Under its shade *Salvadora oleoides* frequently reproduces and on a large specimen one or more climbers are almost always to be found, the commonest in the Central Punjab being *Pentatropis spiralis* and *Cocculus Laeba*. The flower-buds and ripe or unripe fruits are pickled. Flowers: March—April, but sporadically at other seasons.

2. *CAPPARIS SPINOSA*, *Linn. Sp. Pl.* (1753) p. 503.—A trailing shrub, variable as regards its pubescence. Leaves 5-1·5 inches diameter, orbicular, broadly ovate or obovate, apex retuse or obtusely pointed, with a spinous mucro, dull pale-green, thickish; petiole 1-2 inch long; stipules 1 inch long, spinous, stout, yellowish, hooked. Flowers 1·5-2 inches across, white turning pink or purple as they fade, axillary, solitary; peduncles 1-2 inches long, thickened in fruit. Sepals subequal, the two outer concave. Petals 1-1·5 inches long, obovate, undulate. Stamens longer than the petals. Gynophore 1-2 inches long. Berry 1-2 inches long, obovoid, red inside when ripe and dehiscing irregularly. *C. leucophylla*, DC. Collett, Fl. Siml., p. 38, *Caper*.

Plains between the Indus and Jhelum on dry rocky ground. Salt Range. Low inner valleys of the Himalaya, on the Sutlej from Nirth to Wangtu and in Chamba 4-7,000 feet. The plant has a curious distribution similar to that of *Withania coagulans*. The Himalayan specimens referred to *C. leucophylla*, DC., by Collett have a more copious tomentum and larger leaves than are found in some of the plains specimens. But similar forms are found in the Salt Range and intermediate forms occur so that even treated as a variety as is done in the Fl. Brit. Ind. it is not well marked. Flowers handsome; May-July.

3. *CAPPARIS SEPIARIA*, *Linn. Syst. ed.* 10 (1759) p. 1071.—An evergreen climbing shrub, often suberect, twigs pubescent, often zig-zag. Leaves 1-2 inches long, variable, ovate-elliptic or elliptic-lanceolate, obtuse, emarginate or acute, glabrous when mature, bright-green, petiole 1-2 inch long, pubescent; stipules 1 inch long, spinous, hooked, stout, bases pubescent, tips dark-brown, shiny. Flowers 3-5 inch across, white, in sessile or shortly pedunculate umbels; pedicels 5-8 inch long, filiform. Sepals ovate, ciliate. Petals narrowly oblanceolate-oblong. Stamens 3 inch long. Gynophore 2-3 inch long. Fruit 3 inch diameter, globose, smooth, black when ripe. Vern. *Hins*.

Sub-Himalayan tract from the Ravi eastwards and in the adjacent plains. Plains of the East and South-East Punjab. Common in hedges and open scrubby places. Forms a dense undergrowth in parts of the Phillaur Plantation. In dry places usually a suberect shrub often with the branches densely

tangled. In moist places often seen as a climber ascending to the tops of tall trees and with a clean unbranched stem below. The spines are persistent and can be seen even on old stems. Flowers: July—August.

4. *CAPPARIS HORRIDA*, Linn. f. *Suppl.* (1781) p. 264.—A scrambling shrub, sometimes climbing over tall trees; young parts clothed with caducous rusty-brown pubescence. Leaves 2-4 inches long, oblong or ovate, with a stout mucro, ultimately glabrous and shining above; petiole .2-.3 inch long; stipules .1 inch long, spinous, hooked, bases very stout, yellowish. Flowers 1.5-2 inches across, white fading to dull-rose, 2-4 in a vertical line above the leaf-axils or sometimes solitary; peduncles .5-1 inch long, stout. Sepals very concave, rusty-tomentose outside. Petals villous within, margins undulate. Stamens 1.5 inches long. Gynophore 1.5-2 inches long. Berry 1-1.5 inches diameter, subglobose, red-brown when ripe, on a very stout stalk. Brandis Ind. Trees, fig. 14.

Sub-Himalayan tract near the Jumna. Kalesar. Flowers handsome; April—May.

4. *CRATÆVA*, Linn.

(In honor of Crataevas, a Greek botanist who lived in the time of Hippocrates. *DISTRIB.* Species 10; tropics of both hemispheres.)

CRATÆVA RELIGIOSA, Forst. f. *Prodr.* (1786) p. 35.—A medium sized deciduous tree, bark grey, nearly smooth. Leaves trifoliate; petiole 1.5-4 inches long; stipules 0. Leaflets 2-6 by 1.5-2.5 inches, ovate, obovate or lanceolate, acuminate, base attenuate, the lateral oblique, entire, glabrous, pale beneath; petiolules .2-.3 inch long. Flowers 2-3 inches across, white, pale-yellow or reddish-yellow, in many-flowered, lax corymbs; pedicels 1-2 inches long. Sepals 4, deciduous, petaloid, .2-.3 inch long, ovate, acute, imbricate, inserted on the edge of the disk. Petals 4, long-clawed, ovate, open in bud. Disk hemispheric, lobed. Stamens numerous, free, longer than the petals, inserted on the margin of the disk. Ovary ovoid, on a gynophore about 1.5 inches long; placentas 2, ovules many, many-seriate; stigma sessile. Berry 1-2 inches diameter, globose, many-seeded, rind woody, smooth. Seeds reniform, embedded in yellow pulp. Vern. *barna*.

Sub-Himalayan tract from the Ravi eastwards; common. Wild here and there in the plains but probably self-sown from cultivated trees. Wood yellowish, close and smooth-grained, fairly hard. The leaves are much lopped for fodder. Regenerates rather freely from seed and rootsuckers. Often cultivated for its handsome flowers which appear before or with the young leaves in April—May.

VIII. BIXACEÆ.

Trees or shrubs. Leaves alternate, simple; stipules minute or 0. Flowers regular, 1-2-sexual. Sepals usually

4-5, imbricate, deciduous. Petals 4-5 or 0, imbricate or contorted, deciduous. Stamens hypogynous or nearly so, indefinite, rarely definite; anthers 2-celled, dehiscing by slits or pores. Ovary 1, usually 1-celled; ovules usually numerous on several parietal placentas. Seeds frequently arillate or with a pulpy testa. **DISTRIB.** A small family; tropics of both hemispheres.

Leaves palmately lobed; flowers large ... 1. *Cochlospermum*.

Leaves undivided; flowers small.

Styles 2 or more; ovary 2- or more-celled ... 2. *Flacourtia*.

Style 1; ovary 1-celled ... 3. *Xylosma*.

1. COCHLOSPERMUM, Kunth.

(From the Greek, *kochlias*, anything twisted spirally, and *sperma*, a seed. **DISTRIB.** Species 13; 1 Indian, 3 African, 3 Australian, the rest in Tropical America.)

COCHLOSPERMUM GOSSYPIUM, DC. Prodr. I (1824) p. 527.—A small soft-wooded, deciduous tree; branches few, short, thick; bark thick, deeply cracked. Leaves crowded near the ends of the branches, palmately 5-lobed, 3-7 inches diameter, lobes acuminate, entire, glabrous above, more or less white-tomentose beneath; petiole 4-7 inches long, pubescent when young. Flowers 4-5 inches across, bright-yellow, appearing before the leaves, in terminal subcorymbose panicles; pedicels 2-5 inches long, stout, grey-tomentose. Sepals 5, unequal, .5 inch long, elliptic, concave, silky outside. Petals 5, obovate, deeply emarginate. Stamens numerous, inserted on the disk; anthers oblong, opening by pores or short terminal slits. Ovary globose; style simple. Fruit an obovoid capsule 2-3 inches long, striate, 5-valved. Seeds .2 inch long, kidney-shaped, covered with copious soft silky wool.

Sub-Himalayan tract from the Sutlej eastwards. Flowers: March—April. I have seen no Punjab specimens. This tree would be worth cultivating in gardens for ornament.

2. FLACOURTIA, Commers.

(In honor of Etienne de Flacourt, a Governor of Madagascar. **DISTRIB.** Species 15; Africa and Asia.)

FLACOURTIA RAMONTCHI, L'Herit. Stirp. (1784) p. 59, tt. 30, 30 B.—A shrub or small tree, deciduous, armed with axillary thorns and often with tufts of branched thorns on the stem. Leaves variable, 1-3 by 1-2 inches, ovate, broadly elliptic, obovate or suborbicular, toothed or crenate, apex acute or rounded, glabrous or pubescent above, more or less pubescent beneath; petiole .2-.3 inch long. Flowers .3 inch across, greenish-yellow, diceious, in short simple or branched usually tomentose racemes. Sepals 4-5, less than .1 inch long, ovate, hispid and

ciliate, imbricate. Petals 0. Stamens numerous; anthers small versatile, opening by slits. Ovary on a glandular disk; stigmas 5-11, free or connate. Fruit .3-.5 inch diameter, globose, red or dark-brown when ripe, edible, endocarp hard with as many cells as seeds. Seeds 8-16. *F. sapida*, Roxb. Collett, Fl. Siml., fig. 13. Vern. *Kakoh*, *kangu*.

Sub-Himalayan tract and Outer Himalaya ascending to 4,000 feet from the Indus eastwards and in the adjacent plains. Very common. The wood is hard and close-grained. Flowers: March—April.

FLACOURTIA SEPIARIA, *Roxb.*—A much-branched thorny shrub or dwarf tree. Leaves mostly clustered on dwarf shoots, .5-1.5 by .4-.6 inch, glabrous. Flowers axillary, solitary or in small racemose clusters. Stigmas 3-5 on a very short style. Fruit .3 inch diameter. Brandis, Ind. Trees, fig. 16, named *F. Ramontchi*.

Indigenous to East and South India. Cultivated in gardens in the plains. The foliage is finely tinted in spring and autumn. Spreads readily by root-suckers.

FLACOURTIA CATAPHRACTA, *Roxb.*—Cultivated in Lahore. It resembles *F. Ramontchi* but has narrower leaves which are glabrous and long-acuminate.

3. **XYLOSMA**, *Forst.*

(From the Greek, *xulon*, wood, and *osme*, scent. **DISTRIB.** Species 30; tropical and sub-tropical regions of both hemispheres.)

XYLOSMA LONGIFOLIUM, *Clos. in Ann. Soc. Nat. sér. 4, VIII (1857) p. 231.*—A small or medium-sized evergreen tree, usually armed when young with straight axillary thorns. Leaves 3-6 by 1-2 inches, lanceolate or oblong-lanceolate, glabrous, shining above, acuminate, bluntly serrate; petiole .2-.4 inch long. Flowers dioecious, small, yellow, in dense short axillary panicles. Sepals 4-5, less than .1 inch long, ovate, glabrous. Petals 0. Stamens numerous, .15 inch long, surrounded by a lobed glandular disk; anthers short, versatile, opening by slits. Ovary seated on a glandular disk, 1-celled; style almost 0; stigma faintly lobed. Fruit .2 in. diameter, black. Seeds about 6. Vern. *Batti* (Rp.), *Chirindi* (Ka).

Sub-Himalayan tract and Himalaya ascending to 5,000 feet. Common, especially in moist ravines. Reaches a girth of 5 feet and regenerates fairly well in suitably moist places. Seedlings spring up under the shelter of shrubs and stand considerable shade when young. Occasionally planted in gardens in the plains. Wood pinkish, fairly hard and even-grained. Flowers: November—January.

ONCoba SPINOSA, *Forsk.*—A deciduous somewhat thorny shrub with large white flowers 2 inches diameter.

Indigenous to Arabia Felix. Cultivated in Lahore. Flowers: May—June.

IX. PITTOSPORACEÆ.

Trees or shrubs. Leaves alternate, usually coriaceous and entire, exstipulate. Flowers bisexual, usually regular, 5-merous. Sepals free, rarely connate at the base, imbricate.

Petals free, rarely loosely cohering, imbricate. Stamens hypogynous, free, alternating with the petals. Disk 0. Ovary 1-celled with 2-5 parietal placentas, or 2-5-celled by the projection of the placentas; ovules many, parietal or axile, biseriate; style 1; stigma terminal, entire or lobed. Fruit capsular, loculicidal or baccate and indehiscent. Seeds often embedded in sticky pulp. **DISTRIB.** A small family chiefly Australian.

PITTOSPORUM, Banks.

(From the Greek *pitta*, pitch, and *spora*, a seed.)

Fruit a leathery or woody capsule. Seeds many, not winged. **DISTRIB.** Species about 70; tropical and subtropical regions of the old world.

Young shoots, leaves beneath and capsules
tomentose 1. *P. eriocarpum*.

Young shoots, leaves and capsules glabrous . . . 2. *P. floribundum*.

1. **PITTOSPORUM ERIOCARPUM**, *Royle, Illustr. Bot. Himal.* (1839) p. 77.—A small evergreen tree, young shoots grey-tomentose. Leaves 4-7 inches long, oblong-obovate, -elliptic or oblanceolate, acute or shortly acuminate, grey-tomentose on both surfaces when young, when mature glabrous above but more or less woolly along the midrib beneath, lateral nerves rather prominent on the lower surface; petiole .7-1.2 inches long. Flowers .4 inch long, yellowish, in many-flowered compound tomentose often subumbellate corymbs. Sepals .15 inch long, lanceolate, densely tomentose. Petals free, linear, erect with spreading tips. Ovary tomentose; style glabrous, persistent. Capsule .5 inch diameter, globose, densely tomentose, woody, 2-valved with the placentas in the middle of the valves. Seeds many.

Outer Himalaya on hot slopes. Not common but has been collected in Suket State, District Kangra. Flowers: March—April.

2. **PITTOSPORUM FLORIBUNDUM**, *Wight & Arn. Prodr.* (1834) p. 154.—A small evergreen tree, bark dotted with white specks. Leaves 3-6 inches long, lanceolate or oblong-lanceolate, acute or acuminate, thinly coriaceous, shining above, pale beneath, margin undulate, midrib prominent, lateral nerves faint; petiole .5-.7 inch long. Flowers .25 inch long, yellowish, numerous, in much-branched terminal compound corymbs. Sepals .1 inch long, ovate, pubescent outside. Petals free, linear-oblong, erect with spreading tips. Ovary very hairy in the lower part; ovules about 12; style persistent. Capsule .25 inch diameter, globose, orange when ripe, woody, 2-valved with the placentas in the middle of the valves. Seeds about 6, black, shining, in a red sticky pulp.

Sub-Himalayan tract, rare; Kulthea Reserve, Rawalpindi; Bindaraban, Nurpur, Kangra and at Lower Dharmasala. Flowers: January—June. An ornamental plant especially when in fruit.

PITTOSPORUM TOBIRA, *Ait.*—An evergreen shrub. Leaves crowded towards the ends of the branches, 1·5-3 inches long, oblanceolate, apex obtuse, base narrowed, shining above, pale beneath, subsessile. Flowers whitish, fragrant, peduncles 1-flowered.

Native of China and Japan. Cultivated in gardens in the plains and at Abbottabad. Flowers: March—April.

PITTOSPORUM PHYLLEAEOIDES, *DC.*—Leaves linear, the midrib excurrent as a small hooked mucro. Petals connate to the middle or higher.

Indigenous to the dry interior of Australia. Cultivated in Lahore. Flowers: March—April.

PITTOSPORUM RHOMBIFOLIUM, *A. Cunn.*—An evergreen tree. Leaves usually with a few coarse blunt teeth.

Indigenous to Australia. A very ornamental species. Flowers: May.

PITTOSPORUM VIRIDIFLORUM, *Sims.*—Leaves 2-4 inches long, obovate-oblong. Flowers greenish, numerous, in many-flowered terminal pubescent panicles.

Indigenous to South Africa. A large shrub or small tree. Flowers April.

X. TAMARICACEÆ.

Undershrubs or shrubs, rarely trees or perennial herbs. Leaves alternate, small, usually scale-like, stipules 0. Flowers in spikes, racemes or panicles, rarely solitary, usually bisexual. Sepals and petals 5, rarely 4, imbricate, free or connate below. Stamens 5, 10 or indefinite, inserted on an annular glandular disk, free or connate below; anthers versatile. Ovary free, 1-celled or imperfectly septate, of 3-5 carpels; ovules numerous, biseriate on each placenta; styles 3-5, free or connate. Capsules dehiscent, valves as many as styles. Seeds plumed or winged. *DISTRIB.* A small family of temperate and warm regions of the Northern Hemisphere and in S. Africa; often in saline or sandy places.

Stamens 5, free; styles 3 or 4 ... 1. *Tamarix*.

Stamens 10, connate; stigmas sessile ... 2. *Myricaria*.

1. TAMARIX, Linn. (*The Tamarisk*).

(From the Latin name of *T. gallica*.)

Shrubs or small trees. Leaves minute, scale-like, in seedlings lanceolate from a broad base up to ·25 inch long. Flowers white or pink, in spikes or dense racemes. Sepals and petals free. Stamens 5 (in the following species). Styles short; placentas basal. Seeds produced at the apex into a ses-

sile plume, the axis of which is setiform and feathered with long hairs. DISTRIB. Species 65; Europe, Asia and Africa.

A tree; twigs articulate at the base of the leaf sheath; bracts sheathing ... 1. *T. articulata*.

Trees or shrubs; twigs not articulate and bracts not sheathing.

Bracts as long as the flower or nearly so.

Leaves sheathing with a broad white margin... 2. *T. dioica*.

Leaves strongly impressed-punctate... 4. *T. salina*.

Bracts shorter than the flowers ... 3. *T. gallica*.

1. *TAMARIX ARTICULATA*, Vahl, *Symb.* II (1791) p. 48, t. 32.—A medium-sized tree with erect trunk and rough bark. Branches articulate at the base of the sheath, often hoary with saline efflorescence. Leaves sheathing, the free portion consisting of a minute triangular tooth, marked with impressed-punctate glands. Flowers pink, 2- or 1- sexual, scattered on long slender spikes which are usually collected at the ends of the branches in loose panicles. Bracts sheathing, acute, shorter than the flowers. Stamens 5; filaments filiform, inserted in alternate notches on the 10-lobed disk. Styles half as long as the ovary. Vern. *Farāsh*, *pharwān*, *ukan*.

Punjab plains; common and very frequently planted as it is easily grown from cuttings and thrives on saline soil where few other trees will grow. Reaches a height of 60 feet and a girth of 6-7 feet or more but large specimens are almost invariably unsound. The growth is fast but the tree is not long-lived. The wood is used for ploughs, Persian wheels, small ornaments and for fuel but when burnt green it gives an offensive smell. The bark and galls are used for tanning. It is one of the few trees which reproduce at all freely from seed in the rakhis, seedlings being frequently found in hollows where water collects after heavy rain; it also coppices well. Large trees are commonly riddled by a borer. Flowers: May to September, but also at other seasons.

2. *TAMARIX DIOICA*, Roxb. *Hort. Beng.* (1814) p. 22.—Usually a gregarious shrub 6-7 feet high, dioecious. Leaves sheathing, sheath tubular, apex acuminate closely adpressed, with a broad white margin. Flowers purple or pink, in compact peduncled spikes 1-2 inches long, often forming loose drooping panicles at the ends of the branches. Bracts nearly as long as the flower; persistent, lanceolate, acuminate, with membranous white margins. Stamens 5; filaments ligulate, inserted in the notches of a 5-lobed disk. Styles as long as the ovary. Vern. *pilchi*, *lei*, *jhau*.

Abundant on the banks of rivers ascending to 2,500 feet in the Outer Himalaya. The branches are much used for making baskets. Flowers: May—October.

3. *TAMARIX GALLICA*, Linn. *Sp. Pl.* (1753) p. 270.—A shrub or small tree up to 30 feet high. Branchlets slender. Leaves not sheathing, subulate, apex acute, patent or adpressed, base semiamplexicaul, at first imbricate, afterwards distant,

Flowers white or pink, crowded in long slender spikes arranged in large terminal panicles, pedicels short. Bracts shorter than the flowers, semiamplexicaul, acute, membranous. Stamens 5; filaments not dilated at the base, inserted on the margin of the middle of the lobes of the disk. Styles short, jointed to the ovary; stigmas often almost sessile. Vern. *pilchi, lei, jhau*.

Abundant on the banks of rivers. Ascends to 12,000 feet in Tibet (var. *Pallassii*, Desv. sp.). Sometimes cultivated. Flowers: July—August.

4. *TAMARIX SALINA*, Dyer, *Fl. Brit. Ind.* I (1874) p. 248.—Differs from the above in having broader subamplexicaul strongly impressed-punctate leaves, bracts equalling the flowers, filaments dilated at the base and stigmas sessile.

Salt Range.

2. MYRICARIA, Desv.

(A Latinised form of *Murike*, the Greek name for the Tamarisk.)

Fastigiate shrubs. Leaves small, flat, sessile, often crowded. Flowers white or pink, bisexual, in lateral or terminal spike-like racemes. Sepals 5. Petals 5, free. Stamens 10, alternately long and short, monadelphous. Disk almost obsolete. Stigmas 3, sessile; placentas basal; ovules numerous. Seeds usually with a stalked plume. **DISTRIB.** Species about 10; Europe and Temperate Asia.

Flowers pink, leaves .25 inch or less in length ... 1. *M. germanica*.

Flowers white, leaves about .5 inch or more in length ... 2. *M. elegans*.

1. *MYRICARIA GERMANICA*, Desv. in *Ann. Sc. Nat.* IV (1825) p. 349.—An erect shrub. Leaves linear-lanceolate, sessile, up to .25 inch long. Inflorescence 1-18 inches long, lateral or terminal. Flowers pink, pedicellate, in the axils of ovate-lanceolate bracts; bracts 3-4 times as long as the pedicels, with broad membranous margins. Sepals free, lanceolate, equaling the petals. Stamens connate for half their length.

Along streams in the Inner Himalaya above 5,000 feet; common and often gregarious on islands and sandbanks. Flowers: May—August.

2. *MYRICARIA ELEGANS*, Royle, *Illustr. Bot. Himal.* (1839) p. 214.—An erect shrub. Leaves oblong-lanceolate, narrowed at both ends .5-.8 by .1-.15 inch. Inflorescence 3 inches long, lateral. Flowers white, pedicellate in the axils of ovate acuminate bracts; bracts twice as long as the pedicels, with narrow membranous margins. Sepals connate below, triangular, much shorter than the petals. Stamens connate for one-fourth of their length.

Along streams in Kunawar 8-10,000 feet. Spiti and Lahaul. Common near Sangla, growing with *Hippophaë* and *M. germanica* along the Baspa River. Flowers occasionally pink, May.

XI. ELATINACEÆ.

Semi-aquatic or terrestrial herbs or undershrubs. Leaves opposite or whorled, entire or serrate; stipules twin. Flowers bisexual, small, axillary, solitary or in cymes. Sepals and petals each 2-5, free, hypogynous, imbricate. Disk 0. Stamens as many as or twice as many as the sepals, hypogynous, free; anthers 2-celled, versatile, dehiscing longitudinally. Ovary free; cells and styles as many as sepals; ovules many, on the inner angle of the cells; stigmas capitate. Fruit a capsule, valves septicidal, flat or concave, separating from the central column and septa. Seeds straight or curved. **DISTRIB.** A very small family, scattered over the world.

BERGIA, Linn.

(In honor of P. J. Bergius, a professor of natural history at Stockholm and botanical author of the 18th century.)

Annuals or undershrubs. Leaves opposite, serrate or entire. Flowers solitary or in more or less dense axillary fascicles, minute, usually 5-merous. Sepals 2-5, free, acute, with a herbaceous midrib, the margins usually membranous, imbricate. Petals 2-5, free, imbricate. Stamens 10. Ovary ovoid. Capsule subcrustaceous, septicidal. **DISTRIB.** Species 17; warm countries.

Glandular pubescent	...	...	...	1. <i>B. odorata</i> .
Nearly glabrous	...	...	...	2. <i>B. æstivosa</i> .

1. **BERGIA ODORATA**, *Edgew. in Journ. As. Soc. Beng.* VII (1838) p. 765.—A small glandular-pubescent shrub about 1 foot high with deciduous papery bark. Leaves .1-.7 inch long, sub-sessile, often fascicled, oblong-lanceolate to elliptic or ovate, hispid and often glandular on both sides, margins crenate-serrate often reflexed. Flowers .15 inch long, axillary, pedicelled, solitary or in fascicles of 2-8. Sepals ovate, hairy without and on the margins. Petals obovate. Ovary grooved; styles 5, half as long as the ovary. Capsule 5-celled.

Plains of the Punjab. The plant has a smell like that of Chamomile. Flowers: October—January.

2. **BERGIA ÆSTIVOSA**, *Steud. Nom. ed.* 2, I (1840) p. 198.—A small glabrous much-branched shrub with slender divaricate branches. Leaves narrow, obovate or oblong, almost linear on the flowering branches, faintly serrate. Flowers pink, axillary, pedicelled, solitary or in fascicles of 2-4. Sepals lanceolate, denticulate, with membranous margins. Otherwise as for the above.

Plains of the Punjab. Possibly a variety of *B. odorata* but different in habit. Branches lying flat on the ground. Flowers pink, April.

XII. HYPERICACEÆ.

Herbs or shrubs, rarely trees. Leaves opposite, often gland-dotted, exstipulate. Flowers bisexual, regular, solitary or cymose, terminal or rarely axillary. Sepals and petals usually 5 each, free, imbricate. Stamens usually indefinite, 3- or 5-adelphous, rarely free or all connate; anthers versatile. Ovary of 3-5 carpels, 1- or 3-5-celled; ovules few or many on axile or parietal placentas. Fruit capsular or baccate. Seeds straight or curved. **DISTRIB.** A small family in temperate and warm regions.

HYPERICUM, Linn.

(The classical name for some species of the genus. Characters of the family. **DISTRIB.** Species over 200; chiefly in the Northern hemisphere.)

Petals rather longer than the stamens; styles twice as long as the ovary.

Twigs terete; sepals ovate... 1. *H. cernuum*.

Twigs 4-angled; sepals lanceolate... 2. *H. lysimachioides*.

Petals twice as long as the stamens; styles not longer than the ovary... 3. *H. patulum*.

1. **HYPERICUM CERNUUM**, *Roxb. Hort. Beng.* (1814) p. 59.—A shrub 3-6 feet high, much-branched from the base, twigs terete. Leaves 1-3 by .5-1.3 inches, ovate or ovate-lanceolate, decussate, glabrous, glaucous beneath, dotted with small scattered translucent glands, sessile. Flowers 2 inches diameter, bright-yellow, 3-7 in terminal cymes. Sepals .3 inch long, ovate. Petals obovate, rather longer than the stamens. Stamens 5-adelphous at the base. Styles 5, twice as long as the ovary. Capsule .4-.5 inch long, septicidal. Seeds numerous, minute. Collett, *Fl. Siml.*, fig. 18.

Himalaya 3-7,000 feet from the Indus eastwards; common, usually on steep rocky banks. Very showy when in flower in March to May.

2. **HYPERICUM LYSIMACHIOIDES**, *Wall. Cat.* (1828) No. 4817.—A shrub 1-3 feet high, twigs more or less quadrangular. Leaves .8-2 by .25-1 inch, usually lanceolate, sometimes ovate, decussate, glabrous, glaucous beneath, pellucid-punctate, petiole very short. Flowers .8-1.2 inches across, yellow, in 2-3-chotomous, lax, leafy cymes. Sepals .3-.4 inch long, narrow-lanceolate, acute. Petals elliptic, rather longer than the stamens. Stamens 5-adelphous at the base. Styles 5, twice as long as the ovary. Capsule .3 inch long, septicidal. Seeds numerous, minute.

Himalaya 5-8,000 feet. From Chamba and Chota Banghal eastwards. Common in the Simla district. I have seen no specimens from Hazara or Rawalpindi, but it has been collected in Kashmir and Chitral. Flowers: July-August.

3. **HYPERICUM PATULUM**, *Thunb. Fl. Jap.* (1784) p. 295, t. 17.—A shrub 1-3 feet high, twigs terete, red, spreading.

Leaves 5-1·5 by 2-·6 inch, elliptic-lanceolate, distichous, acute, glabrous, glaucous beneath, pellucid-punctate, petiole very short. Flowers 1-1·5 inches across, yellow, in few-flowered cymes. Sepals 2 inch long, elliptic, obtuse. Petals orbicular, twice as long as the stamens. Stamens 5-adelphous at the base. Styles 5, as long as the ovary. Capsule 3 inch long, subglobose, septicidal. Seeds numerous, minute.

Himalaya 3-7,000 feet from the Ravi eastwards. Common on rocks and steep banks but in moister places than *H. cernuum*. Flowers: August—September.

HYPERICUM CHINENSE, Linn.—A plant closely resembling *H. cernuum* but with the styles united almost to the top. Cultivated in gardens in the plains. Indigenous to China. Flowers: March—May.

XIII. TERNSTROMIACEÆ.

Trees or shrubs, rarely climbing. Leaves alternate, simple, more or less coriaceous, usually serrate; stipules 0. Flowers usually showy, bisexual and pentamerous. Sepals free or connate, imbricate, persistent. Petals free or united at the base into a ring, imbricate or contorted. Stamens indefinite, rarely 5, 10 or 15, free or connate or 5-adelphous and often united to the petals; anthers basi- or dorsi-fixed, opening by longitudinal slits, rarely by pores. Disk 0. Ovary superior, rarely half-inferior, 2-10-celled; ovules 2-many in each cell, rarely solitary; styles as many as cells to the ovary, free or united; stigmas usually small. Fruit baccate or capsular. **DISTRIB.** A family of Tropical Asia and America, a few in Africa.

Evergreen, leaves smooth; flowers white, peduncles

1-flowered 1. *Eurya*.

Deciduous, leaves rough; flowers pink, in cymose
panicles 2. *Saurauja*.

1. *EURYA*, Thunb.

(From the Greek, *eurus*, large; wrongly applied to the flowers which are small for the family. **DISTRIB.** Species 30, reduced to 10 by some botanists; warmer parts of Asia, Malaya and the Pacific Islands.)

EURYA ACUMINATA, DC. *Mém. Ternstr.* (1822) p. 29.—An evergreen shrub or small tree, bark smooth, brown, young shoots hairy. Leaves 2-4 by 5-8 inch, narrowly oblong-lanceolate, acuminate, closely crenate-serrate, with gland-tipped teeth, coriaceous, glabrous with depressed midrib above, usually hairy on the midrib beneath; petiole 1 inch long or less. Flowers 2 inch across, white, diœcious, about 5 together in the leaf-axils; peduncles 1 inch long or less, 2-bracteolate. Sepals 5, concave, pubescent outside. Petals 5, 12 inch long and nearly as broad, obtuse, exceeding the sepals, more or less connate below. Stamens 12-15, shorter than the petals and

adnate to them at the base ; anthers adnate to the connective, not versatile. Ovary usually 3-celled ; styles distinct or connate below. Fruit .15 inch diameter, baccate, globose, tipped with the remains of the styles and supported by the persistent calyx.

Sub-Himalayan tract from the Sutlej eastwards 3-7,000 feet (E. M. Coventry). I have seen no Punjab specimens. Flowers : November—December.

2. SAURAUJA, Willd.

(In honor of Sauraujo, a Portuguese botanist. *DISTRIB.* Species 60 ; tropical and sub-tropical Asia and America.)

SAURAUJA NEPAULENSIS, *DC. Mém. Tenstr.* (1822) p. 29.—A small deciduous tree, bark reddish-brown, wood soft, spongy, young parts and inflorescence covered with scurfy tomentum. Leaves crowded towards the ends of the branches, 7-14 by 2.5-4 inches, oblong or oblanceolate, acute or acuminate, sharply serrate, rusty-tomentose beneath especially when young, lateral nerves about 25-30 pairs close and prominent ; petiole 1-1.5 inches long, scurfy tomentose. Flowers .5 inch diameter, pink, in lax, drooping, pedunculate, axillary panicles 4-9 inches long ; peduncle and pedicels tomentose and clothed with scattered stout hairs ; bracteoles elliptic, acute, deciduous. Sepals 5, orbicular, strongly imbricate. Petals 5, connate at the base. Margins fimbriate. Stamens numerous adnate to the base of the petals ; anthers opening at the top by pores or short slits. Ovary 4-5-celled ; ovules many ; styles distinct or shortly connate below. Fruit .4 inch diameter, depressed-globose, 4-5-lobed, green, fleshy with a mealy sweet pulp. Seeds red-brown, small. Brandis, *Ind. Trees*, fig. 27.

Valleys in the Outer Himalaya. Not common, but has been found in Kangra. The fruit is edible. Flowers : April—May.

CAMELLIA THEA, *Vink.*—An evergreen shrub. Leaves 2-4 inches long, elliptic, acuminate, base narrowed, serrate, coriaceous, nearly glabrous ; petiole .1 inch long. Flowers 1-1.5 inches diameter, white, solitary axillary ; bracts 2-3 like the sepals. Sepals 5, coriaceous, concave. Petals 5, broadly obovate, slightly connate. Stamens numerous, cohering at the base and adhering to the base of the petals. Ovary 3-5-celled. Fruit a loculicidal capsule .7-9 inch diameter. Seeds few, large. Vern. *chá. The Tea plant.*

Indigenous to China. Cultivated in the Kangra District. A form indigenous to Assam has larger leaves and a more arborescent habit. It is also sometimes seen.

XIV. DIPTEROCARPACEÆ.

Resinous trees, rarely climbing shrubs. Leaves alternate, simple, entire or sinuate ; stipules usually small and deciduous or larger and persistent or fugacious, leaving an annular scar. Flowers regular, bisexual, fragrant, in axillary or terminal panicles. Calyx-tube free and campanulate or very short and adnate to the base of the ovary ; lobes 5, usually imbricate. Petals

5, contorted, connate at the very base or free. Stamens indefinite, 15, 10 or 5, hypogynous or sub-perigynous, free or cohering or adhering to the petals; filaments short, often dilated at the base; anthers 2-celled, opening by slits; connective often aristate or with an obtuse appendage. Ovary slightly sunk in the torus, usually 3-, rarely 2- or 1-celled; ovules 2 in each cell; style subulate or fleshy, entire or with 3 minute stigmatic lobes. Fruit free or enclosed in the enlarged calyx, indehiscent or 3-valved, usually 1-seeded. **DISTRIB.** Except for 3 African species the family is confined to Tropical Asia.

SHOREA, Roxb.

(In honor of Lord Teignmouth (J. Shore), Governor of Bengal. **DISTRIB.** Species 80; Tropical Asia and Malaya).

SHOREA ROBUSTA, Gaertn. f. *De Fruct.* III (1805) p. 48, t. 186.—A deciduous tree, seldom quite leafless, bark dark-brown, smooth or with a few longitudinal cracks. Leaves 4-12 by 2-7 inches, ovate-oblong, acuminate, tough, thinly coriaceous, glabrous and shining when mature, base cordate or rounded, lateral nerves 12-15 pairs; petiole .5-.8 inch long; stipules .3 inch long, pubescent, deciduous. Flowers .5 inch long, yellowish, in terminal and axillary racemose panicles 3-9 inches long, branches grey-tomentose. Calyx-tube short, not enlarged in fruit, adnate to the torus, lobes .1 inch long, grey-tomentose outside, ovate, accrescent in fruit. Petals narrow-oblong or lanceolate, silky-tomentose outside. Stamens up to 50, shorter than the petals; connectives with subulate bearded appendages, minutely 3-fid at the apex. Ovary 3-celled; style subulate. Fruit .5 inch long, ovoid, acute, indehiscent, pubescent; wings of the fruiting calyx somewhat unequal, oblong or spatulate, 2-3 inches long, obtuse, with 10-15 longitudinal nerves joined by numerous straight or oblique transverse veins. **Vern. sal.**

Sub-Himalayan tract from the Kangra District eastwards. The sal is the most important timber tree of the United Provinces but is of very little importance in the Punjab where it suffers much from frost and does not reach a large size. The extreme limit of the sal is the Andretta Trihai in the Kangra District on the western side of the Beas. Here the sal is found on an isolated hill forming with *Quercus incana*, an underwood in open forest of *Pinus longifolia*. It occurs again on the Siwalik Hills in the Hoshiarpur District, also mixed more or less with *Pinus longifolia*. It is apparently absent to the east of the Sutlej till near the Jumna where it is found as the principal species in the Kalesar forest though even here it does not reach large dimensions.

In Kangra the sal yields mainly firewood, few stems being large and straight enough for timber. In Kalesar it yields some timber and small poles which are in demand owing to the durability of the wood. Information on the sylviculture and uses of sal in other provinces will be found in Gamble's "Manual of Indian Timbers." Flowers: March, April. Fruit: June. The seed germinates immediately on ripening often before it falls to the ground and hence it cannot be kept.

XV. MALVACEÆ.

Herbs, shrubs, or rarely soft-wooded trees, with tenacious inner bark, hairs commonly stellate and juice usually mucilaginous. Leaves alternate, commonly palminnerved, rarely compound; stipules free, often caducous. Flowers regular, usually bisexual, often large and showy and frequently with an involucre of bracts below the calyx. Sepals usually 5, valvate, more or less united. Petals 5, more or less adnate to the base of the staminal-column, twisted or imbricate. Stamens indefinite (rarely definite), monadelphous, rarely 5-adelphous; anthers usually globose or reniform, 1-celled, dehiscent lengthwise. Ovary syncarpous, of 2-5-many carpels whorled round a central axis; ovules 1 or more attached to the inner angle of each carpel; styles free or connate. Fruit of dry dehiscent or indehiscent cocci, or capsular and loculicidal. Seeds usually reniform. **DISTRIB.** A large family of warm and temperate regions.

Herbs, shrubs or undershrubs; staminal tube entire or slightly divided at the apex.

Ripe carpels separating from the axis.

Styles as many as carpels.

Carpels 1-seeded.

Bracteoles 0	...	...	1. <i>Sida</i> .
Bracteoles 3	...	...	2. <i>Malvastrum</i> .
Carpels 2- or more-seeded'...	...	...	3. <i>Abutilon</i> .
Styles twice as many as carpels	...	...	4. <i>Urena</i> .

Fruit capsular.

Stigmas spreading.

Ovary 10-celled	...	...	5. <i>Decaschistia</i> .
Ovary 5-celled	...	...	6. <i>Hibiscus</i> .
Stigmas connate	...	...	7. <i>Thespesia</i> .

Trees; staminal-tube dividing into 5 bundles of stamens.

Leaves simple	...	...	8. <i>Kydia</i> .
Leaves digitate	...	...	9. <i>Bombax</i> .

1. *SIDA*, Linn.

(A name given by Theophrastus to an aquatic plant.)

Herbs or undershrubs with stellate hairs. Leaves simple, toothed, sometimes lobed; stipules linear 2-3 inch long. Peduncles axillary, solitary or clustered, disarticulating in fruit at a constriction below the calyx. Sepals connate for one-half or one-third their length. Corolla small, yellow or white; petals connate and adnate to the staminal-tube. Staminal-tube dividing at the top into numerous antheriferous filaments. Carpels 5-12; styles as many as carpels; stigmas terminal. Fruit

globose, depressed, enclosed in the calyx; carpels separating from each other and from the central axis, usually 2-awned, dehiscent irregularly or by a small chink. Seed solitary, pendulous, smooth. **DISTRIB.** Species about 120; all the warmer parts of the globe; most numerous in America.

The following species are all more or less woody according to age and situation. They flower more or less all the year round. The position of the joint to the peduncles is not an absolutely reliable character in this genus.

Carpels 5. (See also *S. acuta*).

Peduncles jointed below the flower; carpels membranous, beaks half as long as the carpels ...

1. *S. spinosa*.

Peduncles jointed in the middle; carpels without long beaks ...

2. *S. veronicæfolia*.

Carpels 6-10 (sometimes 5 in *S. acuta*.)

Awns shorter than the calyx.

Leaves narrow-lanceolate, glabrous or nearly so; peduncles jointed in the middle equalling the petioles ...

3. *S. acuta*.

Leaves rhomboid-lanceolate or obovate, hoary beneath; peduncles longer than the petioles, jointed near the base ...

4. *S. rhombifolia*

Leaves elliptic or obovate, downy on both sides; peduncles shorter than the petioles, not or indistinctly jointed ...

5. *S. grewoides*.

Awns exceeding the calyx ...

6. *S. cordifolia*.

1. *SIDA SPINOSA*, *Linn. Sp. Pl.* (1753) p. 688.—A suberect branched shrub, stem rough with minute grey stellate hairs, sometimes with 1-3 small recurved spiny tubercles at the base of the petioles or on the stem below them. Leaves .5-2 inches long, very variable, ovate or obovate, cordate, cuneate or truncate at the base, rounded or obtuse-triangular at the apex, crenate-serrate, glabrous above, grey-pubescent beneath, 3-nerved; petiole .5-1 inch long. Peduncles .5-.7 inch long (sometimes less or almost 0), jointed near the top, solitary or clustered. Calyx hairy, lobes triangular. Corolla .5 inch across, pale-yellow. Ripe carpels 5, membranous, equalling the calyx; awns 2, about half as long as the carpel, slightly divergent from a conic base, with spreading or erect hairs.

The plains and hills ascending to 4,500 feet. Common in Changa Manga. There are two forms of this plant: one has the leaves cuneate at the base (*S. alba*, *Linn.*), the other has cordate based leaves (*S. alnifolia*, *Linn.*). The former is not always easy to distinguish from certain forms of *S. rhombifolia* except by its thin-walled carpels and peduncles jointed very high up. The latter resembles *S. cordifolia* but has only 5 carpels. The roots and leaves are used medicinally.

2. *SIDA VERONICÆFOLIA*, *Lamk. Encyc. I* (1783) p. 5.—A perennial much-branched herb or undershrub, branches usually prostrate or trailing, sometimes rooting, clothed with scattered radiating hairs. Leaves .5-2.5 inches long, broadly

ovate or suborbicular, cordate, acute or acuminate, thin, membranous, sparsely hairy, green beneath, crenate-serrate, 5-7-nerved; petiole shorter than the blade. Peduncles .5-1.5 inches long, slender, axillary, solitary or in pairs, jointed at or just above the middle. Calyx 5-angled, hairy; lobes triangular, acute or acuminate. Corolla .3 inch across, pale-yellow, slightly exceeding the calyx. Ripe carpels 5, smooth, blunt or with a small 2-lipped beak. *S. humilis*, Willd. Fl. Brit. Ind., I, p. 322.

Throughout the area ascending to 5,000 feet. Common as an undergrowth in dry forests in places too shady for grass, also on dry rocky banks. The leaves are used medicinally and the plant is used as a pot herb.

3. *SIDA ACUTA*, *Burm. Fl. Ind.* (1768) p. 147.—A small erect undershrub, branches slender terete, smooth or slightly rough with minute stellate hairs. Leaves 1-2.5 inches long, lanceolate, base rounded, apex acute or obtuse, serrate or crenate-serrate, glabrous, pale-green beneath, 3-5-nerved; petiole 0.25 inch long; stipules linear-subulate, veined, ciliate, longer than the petioles. Peduncles 1-2, axillary, shorter or longer than the petioles, jointed near the middle. Calyx subglobose, nearly glabrous; lobes triangular, acute. Corolla .4 inch across, yellow, twice as long as the calyx. Carpels 5-10, rugose, strongly reticulate, awns 2 about one-third the length of the carpel. *S. carpinifolia*, Linn. f. Fl. Brit. Ind., I, p. 323.

The hotter parts. The stem yields a good fibre and various parts of the plant are used medicinally.

4. *SIDA RHOMBIFOLIA*, *Linn. Sp. Pl.* (1753) p. 684.—A small erect undershrub, branches rough with stellate hairs. Leaves up to 2 by .7 inch, variable in shape, glabrous or nearly so above, grey-pubescent beneath, entire towards the base, coarsely toothed towards the tip, 3-5-nerved; petiole up to .25 inch long, pubescent, distinctly swollen in the upper third. Peduncles axillary or crowded towards the ends of the branches. Calyx 5-angled, hairy; lobes triangular, acuminate. Corolla .3-.5 inch across, yellow or white. Carpels 7-10, awns 2, short.

VAR. RHOMBOIDEA (*Sp. Roxb.*)—Leaves rhomboid-lanceolate serrate. Peduncles more than half the length of the leaves, jointed at the base.

VAR. OBOVATA (*Sp. Wall.*)—Leaves broadly obovate, base cuneate entire, apex coarsely crenate-serrate. Peduncles mostly less than half the length of the leaves, jointed about the middle.

The plains and hills to 6,000 feet. Common. On compartment lines, roadsides, etc. *Var. obovata* appears to be the commoner form and to ascend higher in the hills. Yields a good fibre.

5. *SIDA GREWIOIDES*, *Guill., Perr. & A. Rich. Fl. Senegamb. I* (1830) p. 71.—An erect grey-tomentose undershrub. Leaves .5-2 inches long, elliptic-oblong or obovate, obtuse, crenate, downy on both sides, base 5-nerved; petiole .1-.5 inch long. Peduncles 1-2, axillary, 0-.5 inch long, jointed close beneath the calyx. Calyx-tube angular, somewhat enlarged in fruit, sometimes exceeding .5 inch across. Corolla white, slightly exceeding the calyx. Carpels 7-8, hoary, strongly reticulate, awns 2, small, hardly one-third the length of the carpel.

The plains in dry places. Hissar.

6. *SIDA CORDIFOLIA*, *Linn. Sp. Pl.* (1753) p. 684.—A small erect shrub with long spreading hairs on the branches and petioles together with stellate pubescence. Leaves 1-2 inches long, ovate, or ovate-oblong, obtuse, cordate, crenate, downy on both sides, base 5-7-nerved; petiole .5-1.5 inches long, swollen at the top. Peduncles solitary or few together, the lower distant and longer than the petioles, the upper very short and crowded, jointed near the flower. Calyx 10-angled, densely pubescent and with scattered long hairs; lobes ovate, acute. Corolla yellow, slightly exceeding the calyx. Ripe carpels 7-10, strongly reticulate; awns 2, hooked, longer than the calyx, covered with stiff reflexed hairs.

The plains ascending to 3,500 feet. Fairly common and widely distributed. Has more the habit of an *Abutilon* than of the other species of *Sida*. Yields a good fibre.

2. MALVASTRUM, A. Gray.

(From *Malva*, the Mallow, and *ad instar*, like.)

Differs from *Sida* in the flowers being 3-bracteolate and the ovules ascending. **DISTRIB.** Species 60; 2 cosmopolitan in the tropics, the rest American and South African.

MALVASTRUM TRICUSPIDATUM, *A. Gray, Pl. Wright.* (1852) p. 16.—An erect branching herb or undershrub 2-3 feet high. Hairs on the stem, petiole and main nerves on the lower surface of the leaf stellate, few-branched, the branches adpressed, ascending or descending; hairs on the blade often simple. Leaves up to 2.5 inches long, ovate or ovate-lanceolate, irregularly toothed, 5-nerved at the base, nerves impressed above, prominent beneath; petiole up to .7 inch long, not swollen near the blade, flattened or slightly channelled above, densely hairy; stipules .2 inch long, linear, hairy. Peduncles 0-.5 inch long. Bracteoles 3, linear, about half the length of the calyx. Calyx campanulate, cleft about half-way down; lobes 5, triangular, acute. Corolla .5 inch across, pale-yellow, exceeding the calyx,

Staminal-tube antheriferous to the summit with no sterile teeth. Styles as many as carpels; stigmas capitate. Carpels 8-12, reniform, hispid on the top and with 3 projecting points.

The plains; Lahore, Amritsar, Changa Manga. An introduced American plant. Abundant as an undergrowth in Changa Manga plantation, usually herbaceous but sometimes with an erect woody stem $\frac{1}{2}$ inch thick and a total height of 5 feet. Flowers more or less throughout the year.

3. ABUTILON, Tournef.

(An old name for the mulberry said by many to be Greek but apparently first used by Avicenna, an Arabian physician (980-1037); the leaves in many species resemble those of the mulberry.)

Tomentose herbs or shrubs. Leaves ovate, cordate, toothed, angled or lobed, long petioled. Peduncles axillary, solitary, usually 1-flowered; bracteoles 0. Sepals, petals and stamens as in *Sida*. Carpels 5-25; styles long, as many as carpels. Ripe carpels separating from the short central axis, dehiscent, awned or not, 2-5-seeded. Seeds reniform. DISTRIB. Species 170; nearly all warm regions.

As in the *Sidas* the following species are more or less woody according to age and situation. They are in flower or fruit throughout the year.

Carpels more than 10, usually 15-20.

Carpels pointed.

Ripe carpels 3-5 inch long .. 1. *A. indicum*.

Ripe carpels 25-3 inch long ... 2. *A. bidentatum*.

Carpels blunt ... 3. *A. muticum*.

Carpels 8-10.

Leaves green, membranous, glabrescent;

carpels awned ... 4. *A. ramosum*.

Leaves hoary; carpels not beaked or awned ... 5. *A. fruticosum*.

1. ABUTILON INDICUM, Sweet, Hort. Brit. I (1827) p. 54.—Erect, up to 10 feet high and 1 inch diameter, stem quite woody when old and growing in dry places. Leaves up to 3.5 by 3 inches, broadly ovate, cordate, acuminate, irregularly coarsely toothed, rarely subtrilobate, pale and minutely pubescent on both surfaces, often with a few long hairs intermixed, base 7-9-nerved; petiole 1.5-3 inches long, stipules .2 inch long, linear, deflexed. Peduncles longer than the petioles, jointed near the top. Calyx .3-.5 inch long, lobes shallow, ovate, apiculate. Corolla 1 inch diameter, yellow. Staminal-tube hairy at the base. Carpels usually 15-20, sometimes more, longer than the calyx, with short spreading awns, more or less tomentose according to ripeness. Seeds dark-brown, minutely stellately hairy.

Common in weedy places in the plains and in the Sub-Himalayan tract. Yields a good fibre.

2. *ABUTILON BIDENTATUM*, *Hochst. ex A. Rich. Fl. Abyss.* I (1847) p. 68.—Erect, up to 8 feet high, stem green. Carpels $\cdot 25\text{--}\cdot 3$ inch long. Otherwise as for *A. indicum*, from which it is best distinguished by the stem being green usually to the base, the smaller carpels with more prominent and spreading tips. The carpels usually dehisce before breaking away from the central axis, whereas in *A. indicum* the carpels usually break away before dehiscing. Vern. *Pathāka* (Changa Manga).

Distribution as for *A. indicum* with which it is often associated. In Changa Manga the fibre is used for making ropes.

3. *ABUTILON MUTICUM*, *Sweet, Hort. Brit. ed. 2* (1830) p. 65.—A tomentose undershrub. Leaves up to 3-4 inches diameter, suborbicular, cordate, very shortly acuminate or obtuse, irregularly toothed, velvety pubescent or tomentose on both sides, base 7-9-nerved; petioles 1-3 inches long; stipules $\cdot 25$ inch long, linear. Peduncles $\cdot 5\text{--}2$ inches long, jointed near the top. Calyx $\cdot 4$ inch long, lobed half-way down, villous; lobes broad, shortly acuminate. Corolla 1-2 inches diameter, orange-yellow, petals often lobed. Staminal-tube villous at the base. Carpels about 25, densely villous, not beaked. Seeds 3 in each carpel, clothed with minute shining hairs.

The plains; Multan. Apparently not common. I have seen only one Punjab specimen.

4. *ABUTILON RAMOSUM*, *Guill., Perr. & A. Rich. Fl. Senegamb.* I (1830) p. 68.—Erect, shrubby, 4-5 feet high, stems pubescent. Leaves 2-5 inches diameter, cordate, subtrilobate or angular, crenulate, thin, membranous, clothed on both sides with minute scattered pubescence, base 9-nerved; petioles 2-4 inches long; stipules $\cdot 2\text{--}\cdot 5$ inch long, subulate with long spreading hairs. Peduncles solitary or 2-3 together, usually branched above the middle and bearing 2-3 flowers, pedicels jointed close below the calyx. Calyx $\cdot 2\text{--}\cdot 3$ inch long, hairy, lobed to the middle; lobes ovate, shortly acuminate. Corolla $\cdot 6$ inch diameter, yellow. Carpels 8-10, $\cdot 3$ inch long, hairy, with spreading beaks about $\cdot 1$ inch long. Seeds scurfy.

The plains; Phillaur Plantation. The carpels dehisce but remain attached to the axis, the whole fruit breaking off at the joint in the peduncle.

5. *ABUTILON FRUTICOSUM*, *Guill., Perr. & A. Rich. Fl. Senegamb.* I (1830) p. 70.—A much-branched rigid undershrub, closely hoary. Leaves $\cdot 5\text{--}4$ inches long, ovate, deeply cordate, acute or obtuse, crenate, serrate or nearly entire, hoary on both sides, base 7-nerved; petiole up to $2\cdot 5$ inches long; stipules $\cdot 2$ inch long, subulate. Peduncles $\cdot 5\text{--}1\cdot 5$ inches long, slender, jointed close below the flower. Calyx $\cdot 25$ inch long, densely hoary, divided more than half-way down; lobes ovate, acute or

acuminate. Corolla .7 inch diameter, pale-yellow. Staminal-tube clothed at the base with shining hairs. Carpels 10, grey-tomentose, .2 inch long, truncate or scarcely beaked. Seeds dotted with minute white hooked hairs.

The plains ; fairly common.

ABUTILON MOLLE, Sweet.— A branched shrub or undershrub up to 10 feet high and 4 inches diameter. Twigs, petioles and peduncles clothed with long white spreading hairs mixed with viscid pubescence. Leaves up to 7 inches long, orbicular or ovate, deeply cordate, sometimes angular, acuminate, irregularly toothed ; velvety on both sides with viscid pubescence, pale beneath, base 7-9-nerved ; petiole up to 4 inches long ; stipules .25 inch long, linear. Peduncles axillary, as long as or longer than the petioles, 1-3-, usually 2-flowered ; pedicels jointed at, above or below the middle. Calyx .3-5 inch long, densely pubescent and with slender spreading hairs divided nearly to the base ; lobes ovate, acute. Corolla about 1 inch across, orange-yellow. Carpels about 10, .5 inch long, beaked, clothed with long slender hairs. Seeds dotted with short conical curved hairs.

A Peruvian plant cultivated in Lahore and often seen growing spontaneously on canal banks, in hedges, etc.

4. *URENA*, Linn.

(From *uren*, the Malabar name of one of the species. *DISTRIB.* Species 5 ; warm regions of both hemispheres.)

URENA LOBATA, Linn. *Sp. Pl.* (1753) p. 692.—Herbaceous or woody, erect, 2-6 feet high, stem and branches tomentose with spreading stellate hairs. Leaves variable, usually broader than long, up to 4.5 by 6 inches, rounded or ovate, cordate, 3-10-lobed, lobes acute or acuminate, sometimes nearly obsolete, softly hairy on both sides, paler beneath, base 5-7-nerved, nerves prominent beneath, the 3 central or midrib only with an oval glandular pore ; petiole .5-6 inches long, hairy ; stipules linear. Pedicels clustered, very short, hairy ; bracteoles 5, adnate to the calyx, united at the base into a cup, clothed with rigid hairs, oblong or lanceolate, equalling the calyx. Calyx deeply divided ; lobes less than .25 inch long, lanceolate, ciliate. Corolla .5-1 inch across, bright-pink with a darker centre ; petals connate below and adnate to the staminal-tube. Anthers nearly sessile on the staminal-tube. Carpels 5 ; ovules 1 in each carpel ; style 10-branched ; stigmas capitate. Ripe carpels rounded on the back, densely stellately hairy, covered with blunt spines, each spine having 2 straight bristles pointing downwards at an angle from the apex.

Throughout the area ascending to 5,000 feet. Common in shady weedy places. Yields a good fibre. Flowers in the rains and cold weather.

5. *DECASCHISTIA*, Wight and Arn.

(From the Greek *deka*, ten, and *schizein*, to split ; referring to the fruit. *DISTRIB.* Species 2 Indian, 3 Indo-Chinese.)

DECASCHISTIA CROTONIFOLIA, Wight and Arn. *Prodr.* (1834) p. 52.—A tomentose shrub. Leaves 4 by 2 inches, ovate

or slightly lobed, coarsely toothed, velvety on both sides with short dense tomentum, whitish beneath, midrib with a glandular pore at the base; petiole 1·5 inches long. Peduncles longer than the petiole. Bracteoles 10, nearly as long as the calyx. Sepals 5, connate below, triangular, acuminate. Petals 5, connate below and adnate to the staminal-tube. Staminal-tube bearing many filaments below the apex. Ovary 10-celled; ovules 1 in each cell; styles 10, connate below; stigmas capitate. Capsule loculicidally 10-valved, slightly hispid. Seeds reniform, glabrous, ascending.

The plains near Delhi. Has apparently not been collected since Royle's time.

6. HIBISCUS, Linn.

(The classical name of *Althæa officinalis*, the Marsh Mallow.)

Herbs, shrubs or trees. Leaves usually more or less palmately lobed. Flowers axillary, solitary or in a terminal raceme. Bracteoles 4-12, rarely 0, free or connate. Sepals 5, valvate, more or less united into a 5-toothed calyx, sometimes spathaceous and circumsceiss. Petals 5, connate at the base and adnate to the staminal-tube. Staminal-tube truncate or 5-toothed at the apex; filaments numerous. Ovary 5-celled, cells opposite the sepals; ovules 3 or more in each cell; styles 5, connate below; stigmas capitate or spathulate. Capsule loculicidally 5-valved, sometimes with a separate endocarp or with false dissepiments forming a spuriously 10-celled fruit. Seeds tomentose or woolly. DISTRIB. Species about 150; mostly tropical.

Leaves long and narrow, the lower often

3-lobed

... 1. *H. hirtus*.

Leaves broad-ovate, not lobed

... 2. *H. micranthus*.

1. *HIBISCUS HIRTUS*, Linn. *Sp. Pl.* (1753) p. 694.—Shrubby. Leaves 3-5 by 1-2·5 inches, ovate, acuminate, serrate, the lower often shortly 3-lobed, more or less stellately hairy on both sides; petioles ·5-2 inches long; stipules ·5 inch long, subulate. Peduncles axillary, as long as or longer than the leaves, covered with spreading hairs, jointed below the flower. Bracteoles 6-9, subulate, shorter than the calyx. Calyx hairy, divided nearly to the base; lobes linear-lanceolate, ·5 inch long. Corolla about 1 inch across, white or occasionally pink. Staminal-tube toothed at the top; anthers in tufts. Capsule globose, a little shorter than the calyx. Seeds clothed with long white hairs.

The plains. Apparently not common. I have seen no Punjab specimens.

2. *HIBISCUS MICRANTHUS*, Linn. *f. Suppl.* (1781) p. 308.—Shrubby, erect, branches scabrid with stellate hairs. Leaves

·7-1 inch long, ovate or oblong, acute or obtuse, serrate, sometimes cordate, scabrid on both sides; petioles usually very short especially those of the upper leaves. Peduncles axillary, as long as or longer than the leaves, jointed near the top. Bracteoles 7-8, linear, shorter or longer than the calyx. Calyx about 1 inch long, deeply divided, hairy; lobes lanceolate. Corolla about ·6 inch across, pink and white. Anthers in tufts on the staminal-tube. Capsule ·25-·3 inch diameter, globose, Seeds cottony.

The plains; Delhi.

The following species are commonly cultivated in gardens:—

HIBISCUS ROSA-SINENSIS, *Linn.*—A large evergreen shrub. Leaves 3-4 inches long, ovate or ovate-lanceolate, acuminate, coarsely toothed, glabrous or nearly so. Peduncles solitary, axillary, 3-5 inches long, jointed above the middle. Bracteoles 5-7, lanceolate, half as long as, or nearly equalling the calyx. Calyx divided nearly half-way down. Corolla 4 inches diameter. Staminal-tube much exserted, 5-toothed at the apex. Fruit not produced in India.

The *shoe-flower*, probably a native of China. The flowers are normally red, but there are many varieties varying from crimson to pale-salmon, either single or double. Propagated by cuttings. Flowers: April—September.

HIBISCUS SCHIZOPETALUS, *Hook. f.*—Similar to the above in habit and foliage. Bracteoles minute. Calyx shortly toothed at the apex, splitting down one side. Corolla 2 inches across, pink, petals deeply lacinate. Fruit apparently not produced in India.

A native of Tropical Africa. Propagated by cuttings. Flowers: April—September.

HIBISCUS MUTABILIS, *Linn.*—Arborescent but usually grown as a shrub, deciduous. Leaves 4-5 inches across or more, cordate, 5-7-lobed or -angled, irregularly crenate-dentate, more or less softly pubescent or tomentose. Peduncles axillary, 3-5 inches long, jointed near the flower. Bracteoles 7-10, linear-lanceolate, shorter than the calyx. Calyx velvety-pubescent. Corolla 3-4 inches across, white or pink in the morning, changing to red before night, often double.

A native of China. Usually grown with double flowers. Propagated by cuttings which root readily or by seed. Flowers: September—October.

HIBISCUS SYRIACUS, *Linn.*—A deciduous shrub. Leaves ·5-2 inches long, cuneate at the base, the lower ovate or rhomboid-ovate, the upper more or less 3-lobed, glabrous or nearly so. Peduncles axillary, short. Corolla 2 inches across, lilac-blue with a dark purple centre or white.

Native country uncertain. Cultivated in the plains and in hill stations. There are double varieties of both blue and white forms. Easily propagated by cuttings. Flowers: June--August.

7. *THESPESIA*, Soland. ex Corr.

(From the Greek, *thespesios*, divine; *T. populnea* is frequently planted near temples in the tropics. *DISTRIB.* Species about 6; Tropical Asia, Africa and Polynesia.)

THESPESIA MACROPHYLLA, *Blume, Bijdr.* (1825) p.73.—An erect shrub, 3-4 feet high. Leaves 3-6 inches long, cordate, more or less 3-lobed, lobes triangular, acuminate, finely reticulately veined, glabrescent above, stellate-tomentose and with black glandular dots beneath, midrib with a glandular pore

near the base; petiole 1·5-3·5 inches long; stipules subulate, caducous. Peduncles axillary, 3-flowered; pedicels ·25-·5 inch long. Bracteoles 5, small, subulate, deciduous. Calyx cupular, truncate, persistent, with 5 small teeth on the margin. Corolla 3 inches diameter, yellow with a crimson centre. Staminal-tube 5-toothed at the apex. Capsule 1 inch long, ovoid, pointed, 5-, rarely 4-valved, valves pilose. Seeds glabrescent. *T. Lampas*, Dalz. & Gibs. Fl. Brit. Ind., I, p. 345.

Sub-Himalayan tract from the Sutlej eastwards. I have seen no Punjab specimens. Common in ravines and as an undergrowth in sal forests east of the Jumna. Flowers during the rains.

8. KYDIA, Roxb.

(In honor of Colonel Robert Kyd, founder and first Director of the Calcutta Botanic Gardens. DISTRIB. Species 2; Indian.)

KYDIA CALYCINA, Roxb. *Hort. Beng.* (1814) p. 51.—A small deciduous tree, bark grey, exfoliating in long strips; young parts stellately tomentose. Leaves 3-6 inches long, rounded, cordate, palmately 7-nerved, usually more or less 3-7-lobed, glabrous or nearly so above, hoary-tomentose beneath, the 3 central nerves or midrib only with a slit-shaped glandular pore near the base on the lower surface; petiole 1-3 inches long; stipules ·3-·4 inch long, spatulate or with an orbicular limb, fugacious. Flowers ·5-·7 inch across, white, polygamous, in many-flowered axillary and terminal tomentose panicles; pedicels ·4 inch long; bracteoles 4-6, ·25-·4 inch long, oblong-spathulate, connate below, strongly nerved; in fruit accrescent, spreading, brown. Sepals 5, ovate, acute, connate below the middle, incurved over the fruit. Petals obcordate, exceeding the calyx, clawed, with a tuft of hairs on each side of the base of the claw. Staminal-tube hairy at the base and adnate to the corolla, divided about the middle into 5 spreading branches each bearing 3 subsessile anthers; reduced or wanting in the female flower. Ovary 2-3-celled; styles 2-3-cleft; stigmas 2-3, peltate, imperfect in the male flower; ovules 2 in each cell, ascending. Capsule subglobose, loculicidally 3-valved, woody, covered with mealy tomentum, the size of a very small pea. Seeds usually 3, reniform, furrowed, brown-black. Vern. *Pulian* (Haz. & Rp.), *pūla*.

Along the base of the Himalaya from the Indus eastwards. Local in Hazara and Rawalpindi; common in Kangra. Bast fibres used for coarse rope. Wood white, soft, little used. Flowers: July—October. Cultivated in Lahore and flowers in November.

9. BOMBAX, Linn.

(From the Greek *bombux*, silk-worm. DISTRIB. Species 10; chiefly in tropical America.)

BOMBAX MALABARICUM, DC. *Prodr.* I (1824) p. 479.—A tall deciduous tree. Trunk usually undivided, bark grey, covered

with sharp conical prickles which disappear with increasing age, base of the stem buttressed, branches in whorls. Leaves digitate, large, spreading, glabrous; leaflets 5-7, 4-8 inches long, lanceolate, acuminate, acute at the base, more or less coriaceous, glabrous, entire; common petiole longer than the leaflets; petiolules 1 inch long, stipules small or sometimes nearly 1 inch long, thick, triangular, caducous. Flowers large, numerous, appearing before the new leaves, crimson (or occasionally yellowish or white) on short thick pedicels clustered towards the ends of the branches. Calyx thick, fleshy, cupshaped, smooth outside, bright silky-hairy within, margin slightly lobed; coming away from the receptacle with the stamens and corolla. Corolla tomentose without, sparingly pubescent within; petals oblong, 3-6 inches long, recurved, fleshy, with close parallel veins. Stamens inserted at the base of the calyx, adnate to the petals, arranged in 5 bundles opposite to the petals and an inner bundle of 15 of which the 5 innermost are longest; filaments flattened, pink, slightly pubescent, connate only at the base, about half as long as the petals; anthers long, brown, ultimately twisted. Ovary conical, glabrous 5-celled, cells many-ovuled; style longer than the stamens, clavate; stigmas 5, linear .25 inch long. Capsule 4-5 inches long, oblong-ovoid, loculicidally 5-valved; valves woody, downy without, lined with white silky hairs within. Seeds obovoid, smooth, .25 inch long, packed in white cotton. *Silk-cotton tree*. Vern. *Simbal*, *Simal*.

Outer Himalaya ascending to 3,000 feet in Hazara and to 4,000 feet in the Simla District. A tree of rapid growth reaching large dimensions in deep moist soil. On the dry rocky hills in Hazara and Rawalpindi the Simal though reproducing fairly well from seed remains a small ungainly tree but under cultivation and in some of the dense scrub jungles of the Kangra District it reaches a considerable size. Being strongly light demanding it expands its crown well above the surrounding vegetation. Wood light, soft. Large trees can usually be sold readily for planks and straight poles are much in demand for water pipes. The leaves are not eaten by goats but are lopped for kine and buffaloes. The flower-buds are eaten and the cotton is used for stuffing pillows and quilts. Leafless during the cold season except when irrigated when it is only leafless during February and March during which months the flowers appear.

MALVAVISCUS ARBOREUS, Cav.—A shrub. Leaves up to 3 by 2.5 inches, more or less 3-lobed. Flowers scarlet, axillary .7-1 inch long. Calyx surrounded by an involucre of 7-9 linear bracteoles. Staminal-column slender, much exserted. Carpels fleshy outside, connate into a berry, ultimately dehiscent.

Indigenous to the West Indies and Mexico. Cultivated in Lahore.

LAGUNARIA PATERSONII, G. Don.—A tree, large in its native country, small in the Punjab. Leaves 2-4 inches long; elliptic-oblong, thickish, densely white-tomentose beneath when young. Flowers large, deep pink, axillary on short thick pedicels.

Indigenous to Queensland. Cultivated in Lahore and Amritsar. Flowers : May.

XVI. STERCULIACEÆ.

Herbs, shrubs or trees, as a rule with soft wood and often with strong bast fibres, juice frequently mucilaginous, herbaceous portions usually with stellate hairs. Leaves alternate, simple, often palmately lobed, stipules usually caducous. Inflorescence axillary or terminal, usually cymose. Flowers usually bisexual, sometimes zygomorphic. Sepals 5, valvate, more or less connate. Petals 5, contorted or wanting. Stamens in two series, those opposite the sepals reduced to staminodes or wanting, those opposite the petals often indefinitely branched, more or less monadelphous; anthers 2-celled. Ovary sessile, or together with the stamens, raised on an androgynophore; carpels usually 5, opposite the petals; ovules 2-many in each cell; styles as many as cells, free or connate. Fruit various, usually dry. **DISTRIB.** A large tropical family.

Petals wanting; fruit of distinct carpels ... 1. *Sterculia*.

Petals present.

Flowers zygomorphic; carpels spirally twisted 2. *Helicteres*.

Flowers regular.

Trees; bracteoles caducous; seeds winged ... 3. *Pterospermum*.

Shrubs; bracteoles persistent; seeds not winged 4. *Mehania*.

1. STERCULIA, Linn.

(From *Sterculius*, a god, derived from *stercus*, dung. "The Romans in the height of paganism deified the objects of their greatest dislike and most immoral actions. Thus they have the gods Sterculius, Crepitus and the goddesses Caca and Pertunda, &c." The flowers and leaves of some species of *Sterculia* are very foetid. **DISTRIB.** Species 70, most numerous in Tropical Asia.)

STERCULIA VILLOSA, Roxb. *Hort. Beng.* (1814) p. 50.—A deciduous tree, bark light-grey, smooth, young shoots petioles and inflorescence tawny-tomentose. Leaves 10-18 inches long and broad, crowded at the ends of the branches, cordate, deeply palmately 5-7-lobed, lobes oblong or ovate-oblong, abruptly acuminate, entire, toothed or cleft, glabrescent or thinly stellately hairy above, velvety pubescent with spreading hairs intermixed beneath; petiole 12-24 inches long, hollow, downy, swollen near the top; stipules lanceolate, caducous. Flowers .7 inch across, yellow, polygamous, mostly male, in panicles 6-12 inches long, appearing at the ends of the shoots when the tree is leafless. Calyx campanulate, pinkish within, downy without, cleft to the middle, lobes oblong-lanceolate, acute. Petals 0. Staminal-column a membranous ring bearing on its edge 10 anthers. Ovary globose, stellately hairy, on a stout cylindric gynophore .1 inch long; style stout, hairy, deflexed; staminodes on a ring beneath the ovary. Fruit of about 5, distinct follicles, each follicle sessile, spreading, red when ripe.

coriaceous, clothed especially outside with stiff stellate hairs, 1.5-2.5 inches long. Seeds several in each follicle, smooth, black. Brandis, Ind. Trees, fig. 37.

Sub-Himalayan tract from the Indus eastwards. Salt Range. Usually quite a small tree though not uncommon on dry rocky ground. Wood soft and valueless, but the bark yields a strong coarse fibre used for ropes. In very dry places the tree is leafless from November to June. Cultivated in Lahore. Flowers : March—April.

Many species of this genus are seen in cultivation : —

(i) **Follicles thin, membranous.**

STERCULIA COLORATA, Roxb.—Leaves 4-8 inches long, broader than long 3-5-lobed, lobes long-acuminate, quite glabrous except when young. Flowers about 1 inch long, orange-red, appearing before the leaves. Calyx funnel-shaped. Follicles 3 inches long, membranous, veined, opening before maturity and bearing usually one seed on each margin. Brandis, Ind. Trees, fig. 40.

Native of South India. Flowers : April.

STERCULIA PALLENS, Wall.—Leaves 8-12 inches diameter, rather obscurely 3-5-lobed, scabrid above, clothed beneath with pale-yellowish tomentum. Flowers 5-7 inch long, pale-yellow, appearing before the leaves. Follicles as in *S. colorata*.

Indigenous east of the Jumna. Flowers : May.

STERCULIA PLATANIFOLIA, Linn. f.—Leaves 4-10 inches long, 3-5-lobed, lobes ovate, acuminate, glabrescent above, clothed beneath with minute grey stellate pubescence. Flowers 5 inch long, greenish, appearing after the leaves in large terminal panicles. Calyx cleft nearly to the base, lobes linear-oblong. Follicles as in *S. colorata*.

Native of China and Japan. Does very well in the Punjab and stands frost. Bark smooth, greenish. Flowers : May.

(ii) **Follicles woody.**

STERCULIA ALATA, Roxb.—Leaves 4-10 by 3-7 inches, ovate, cordate, glabrous, not lobed. Flowers 1 inch across, brownish. Calyx cleft nearly to the base, tomentose without. Follicles about 5 inches diameter, subglobose, woody.

Indigenous to Madras, Burma and the Andamans. Cultivated in Lahore and Delhi. Flowers : May.

STERCULIA DIVERSIFOLIA, G. Don.—Evergreen, stem greenish, much swollen towards the base. Leaves very variable, entire, ovate or ovate-lanceolate or more or less deeply 3-5-lobed, quite glabrous. Flowers 6-7 inch across, whitish. Calyx very broadly campanulate, slightly tomentose when young. Follicles 1.5-3 inches long, ovoid, woody, on stalks 1-2 inches long.

Indigenous to Australia. Often grown in gardens in the Punjab and known as the *Bottle tree* as is the following species. The true *Bottle tree* of Australia is *S. rupestris*, Benth. Flowers March-May.

STERCULIA TRICHOSIPHON, Benth.—Deciduous, stem disproportionately thickened, more or less like a bottle. Leaves 4-8 inches long, more or less deeply 5-7-lobed, glabrous. Flowers white, 7 inch long. Calyx narrowly tubular-campanulate. Follicles 2-3 inches long, oblong-triangular, shortly stipitate, woody.

Indigenous to North Australia and Queensland. Has long been grown in Saharanpur and recently in Lahore ; Kapurthala. Flowers : April.

2. *HELICTERES*, Linn.

(From *helicter*, a twisted bracelet ; in allusion to the twisted fruit. **DISTRIB.** Species 40 ; tropics of both hemispheres, chiefly American.)

HELICTERES ISORA, Linn. *Sp. Pl.* (1753) p. 963.—A shrub, young parts stellately-hairy. Leaves 3-6 by 2-4 inches, distichous, oblong, obovate or orbicular, shortly acuminate, often 3-lobed, obliquely cordate or rounded at the base, irregularly toothed, rough above, stellately pubescent beneath, basal nerves 4-7 ; petiole 2-4 inch long, stipules subulate, deciduous, 2 inch long. Flowers solitary or in few-flowered minutely bracteolate clusters, 1-1.5 inches long, bilabiate. Calyx 6-8 inch long, 2-lipped, narrowly campanulate, curved, laterally compressed, gibbous, stellately hairy without ; teeth triangular unequal. Corolla red, turning to lead-colored ; petals 5, very unequal, closely reflexed on the calyx, the two lower shorter and broader than the 3 upper, separate but with the claws closely hooked together ; claws winged. Staminal column fused with the gynophore, much exserted, suddenly deflexed ; anthers 10 in a ring round the ovary and alternating in pairs with 5 minute scale-like staminodes within the staminal tube. Ovary conical on a curved gynophore 1.5 inches long ; styles united, equaling the ovary, deflexed. Fruit cylindric, 2 inches long, composed of 5 spirally twisted, stellately tomentose follicles on a long gynophore. Seeds numerous. Vern. *maror-phal* (Ka.).

Sub-Himalayan tracts from the Jhelum eastwards ; common. The hazel-like foliage is renewed in April and the flowers appear in the hot and rainy seasons. The bark yields a strong fibre and the fruits are used in Native medicine but are of doubtful value.

3. *PTEROSPERMUM*, Schreb.

(From *pteron*, a wing, and *sperma*, a seed ; referring to the seeds being winged. **DISTRIB.** Species about 18 ; Tropical Asia.)

PTEROSPERMUM ACERIFOLIUM, Willd. *Sp. Pl.* III (1800) p. 729.—A large evergreen tree with smooth grey bark. Branchlets and inflorescence clothed with ferruginous tomentum. Leaves 6-12 by 5-10 inches, obovate to orbicular, often peltate, sinuately lobed, entire or remotely toothed, coriaceous, glabrous and dark-green above, grey-tomentose beneath, palmately 8-10-nerved, lateral nerves 4-6 pairs ; petiole 3-6 inches long ; stipules multifid, caducous. Flowers 1-3 together, axillary, fragrant, white, 5-6 inches across, on short thick peduncles ; bracts multifid. Calyx deeply 5-cleft, segments linear, up to 5 inches long, deciduous. Petals linear or obliquely cuneate, revolute, slightly shorter than the sepals, deciduous with the calyx. Staminal-column tubular, 1 inch long, adnate to the gynophore, bearing 15 stamens alternating in threes with 5 staminodes ;

anther-cells linear, parallel, .5 inch long. Ovary inserted within the top of the staminal-column, oblong, 5-angled, 5-celled; ovules 12-20 in each cell. Capsule 4-6 inches long, oblong, woody, 5-angled, brown-tomentose without. Seeds obliquely oval, compressed, with large thin brown membranous wings.

Very commonly planted in gardens in the plains and occasionally planted by villagers in the Kangra District. I have a note by Mr. E. M. Coventry "West to the Beas, rare" but I have not seen it wild anywhere in the Punjab. In the Dehra Dun this is mainly a tree of swampy places but under cultivation it thrives with a moderate amount of moisture. Flowers: April—June. Seeds ripen in the cold weather.

PTEROSPERMUM LANCEAFOLIUM, Roeb.—A small tree. Leaves lanceolate, tomentose beneath. Grown in gardens in the plains but not often. Lahore, Hoshiarpur. Indigenous to Assam.

4. *MELHANIA*, Forsk.

(From Mt. Melhan in Arabia Felix, where the first species of the genus was discovered.)

Herbs, undershrubs or shrubs. Leaves simple, ovate or cordate, toothed. Peduncles axillary, 1-few-flowered. Flowers usually yellow, bracteate, bracts often longer than the calyx. Sepals 5, connate below. Petals 5, marcescent. Stamens 5, alternating with 5 staminodes, filaments shortly connate; anther-cells parallel. Ovary sessile, 5-celled; cells 1-many-ovuled; styles 5, connate below, stigmatose on their inner faces. Capsule loculicidally dehiscent. *DISTRIB.* Species about 16; Africa, the warmer parts of Asia and Tropical Australia.

Plants of this genus appear to be very variable and specimens from the Punjab have been referred to three species, those with the larger more membranous leaves being referred to *M. abutiloides*, Arn. I have seen no specimens from Punjab which are quite like the fig. in Wight Icon., t. 23. Of the remainder, specimens with larger and broader bracteoles have been referred to *M. futteyporensis*, Munro and those with narrower bracteoles to *M. tomentosa*, Stocks. The bracteoles vary considerably and a classification based on them alone seems quite unreliable. I consider all the Punjab specimens forms of one species.

MELHANIA FUTTEYPORENSIS, Munro, *ex Mast. in Hook. f. Fl. Brit. Ind.* I (1874) p. 373.—A cano-pubescent undershrub 2-3 feet high. Leaves 2-3 inches long, oblong, oblong-lanceolate or sometimes ovate, slightly cordate or rounded at the base, usually rather thick, softly tomentose on both surfaces especially the lower; petiole 1 inch long or less; stipules setaceous, about as long as the petioles. Peduncles axillary and terminal, 2-4-flowered. Bracteoles very variable, cordate-ovate to lanceolate, the edges recurved, or not, equalling or shorter than the calyx. Sepals lanceolate, acuminate, villous outside. Petals exceeding the sepals, .5 inch long or more, yellow. Capsule .5 inch long, ovoid, villous. *M. tomentosa*, Stocks.

Dry hills of the Punjab ; common. Not found in the moist Sub-Himalayan tract or on flat ground in the plains. Common Trans-Indus and in Rajputana in the undergrowth of very dry open forest. Flowers towards the end of the rains.

ABROMA AUGUSTA, *Linn. f.*—A large shrub or small tree with purple flowers 2 inches across and large prominently 5-angled capsules. *Devil's cotton.*

Native or cultivated in the hotter parts of India. Occasionally grown in gardens. Delhi. In Lahore it suffers a good deal from frost. Yields a good fibre. Flowers : August—September.

GUAZUMA TOMENTOSA, *Kunth.*—A tree. Leaves 3-4.5 by 2 inches, oblong-ovate, obliquely cordate, acuminate, serrate, scabrid above, pubescent beneath, base 5-7-nerved. Flowers small, in axillary cymes. Sepals 5, connate below the middle, at first spathaceous. Petals 5, concave at the base, prolonged into 2 narrow ligulate processes. Stamens 10, connate into a column which is tubular below and consists above of 5 fertile 3-antheriferous filaments opposite the petals, alternating with 5 lanceolate staminodes ; anthers 2-lobed ; lobes divergent. Ovary 5-celled ; styles more or less connate. Capsule 5-1 inch long, globose or oblong, woody, covered with blunt tubercles, black when ripe.

Indigenous to Tropical America. Occasionally cultivated in gardens in the plains. Flowers : May and again in September—October.

HERITIERA MACROPHYLLA, *Wall.*—A large tree. Leaves 7-14 inches long, elliptic-oblong, acuminate, bright silvery beneath. Flowers unisexual, small, pink, in axillary panicles half the length of the leaves. Petals 0. Fruit woody, globose with an abrupt flat beak. *Looking-glass tree.*

Indigenous to Assam. Cultivated in Lahore and does very well. It is frost hardy and deserves to be more widely grown. Flowers : May - June.

DOMBEYA, *Cav.*—Shrubs. Leaves cordate, palminerved. Flowers in pedunculate axillary cymes or umbels ; bracts 3, unilateral, caducous. Calyx 5-partite ; lobes lanceolate, reflexed in flower. Petals 5, oblique, cuneate-obovate, marcescent. Staminal-column tubular at the base, dividing into 5 ligulate staminodes, with usually 3 fertile stamens interposed. Ovary 2-5-celled ; ovules 2-3 in each cell ; styles free or connate. Capsule loculicidal. *DISTRIB.* Species 20-25 ; Africa and the Mascarenes.

Several species have been introduced ; the two following are the most frequent in gardens.

DOMBEYA ACUTANGULA, *Cav.*—Leaves 3-4 inches diameter, clothed on both sides with short stellate hairs or nearly glabrous, shallowly 3-5-lobed ; petiole 2-3 inches long. Flowers white or pink, in many-flowered cymes ; peduncles as long as the petioles, villous ; pedicels about .5 inch long, villous. Sepals .3 inch long. Petals .4 inch long. Filaments united at the base only. Ovary densely tomentose ; styles free at the tips.

Indigenous to the Mascarenes. Cultivated in gardens in the plains. Flowers freely in November.

DOMBEYA MASTERSII, *Hook. f.*—Leaves 3-4 inches diameter, slightly pubescent above, softly hairy beneath, sometimes obscurely 3-lobed ; petiole 2 inches long. Flowers white, in many-flowered axillary umbels ; peduncles and pedicels villous with long spreading hairs, the former as long as the petioles, the latter slender, .8-1.5 inches long. Sepals .4 inch long. Petals .7 inch long. Filaments united for half their length so as almost to obscure the ovary. Ovary densely villous ; styles free at the tips.

Indigenous to Tropical Africa. Cultivated in gardens in the plains. Flowers : February—March.

XVII. TILIACEÆ.

Trees, shrubs or herbs, often with strong bast fibres and usually with mucilaginous juice. Leaves usually alternate, entire, toothed or rarely lobed; stipules usually caducous. Flowers regular, usually bisexual, axillary or terminal, usually in cymes. Sepals 3-5, free or connate, usually valvate. Petals sometimes wanting, usually large and colored, often with a glandular spot at the base. Stamens inserted on the torus near the petals or raised on an androgynophore, usually indefinite, free, connate into a ring or 5-10-adelphous, all antheriferous or some reduced to staminodes; anthers 2-celled; cells parallel, dehiscing longitudinally or by an apical pore, rarely divergent and confluent at the top. Ovary 2-many-celled; ovules 1-many in each cell; style simple with a capitate stigma or divided into as many branches as there are cells to the ovary. Fruit various. **DISTRIB.** A family of the tropics of both hemispheres, rarer in temperate regions.

Trees or shrubs; fruit indehiscent	...	1. <i>Grewia</i> .
Herbs or undershrubs.		
Fruit indehiscent, echinate	...	2. <i>Triumfetta</i> .
Fruit capsular	...	3. <i>Corchorus</i> .

1. GREWIA, Linn.

(In honor of N. Grew, an English physician, who died in 1711; he was the first English writer on vegetable anatomy.)

Deciduous shrubs or trees, occasionally scrambling, twigs, leaves and sepals usually clothed with stellate hairs. Leaves alternate, distichous, more or less distinctly toothed, rarely lobed, base 3-7-nerved. Flowers usually yellow or orange, in pedunculate cymes, peduncles solitary or fascicled, axillary or leaf-opposed. Sepals 5, valvate, often colored on the inside, deciduous. Petals 5, shorter than the sepals usually with a thickened base (claw) bearing on the inside a glandular area surrounded by a villous rim. Stamens usually indefinite, inserted on an androgynophore. Ovary 2- or 4-celled; ovules usually 8; style one, subulate; stigma broad, more or less distinctly lobed or lacinate. Fruit a drupe, often lobed, containing 1-4 pyrenes which are 1-2-many-seeded, endocarp usually bony, mesocarp fibrous. **DISTRIB.** Species about 100; tropical and sub-tropical regions of the old world.

The glandular basal portions of the petals are erect and surround the base of the androgynophore, which is glabrous at the base for a length equal to the length of the claws of the petals, above this it is tomentose or hairy. If the petals have no claws as happens sometimes in *G. elastica* there is no glabrous base to the androgynophore.

Small or medium-sized trees.

Leaves 3-nerved.

Leaves ovate, rather thick, pubescent	...	1. <i>G. oppositifolia</i> .
Leaves elliptic, narrow, thin, nearly glabrous	...	2. <i>G. laevigata</i> .

Leaves 5-7-nerved.

Leaves usually rounded or slightly cordate at the base, finely serrulate; petioles 2-5 inch long ... 3. *G. elastica*.

Leaves usually distinctly cordate, distinctly serrate; petioles 4-8 inch long ... 4. *G. subinaequalis*.

Shrubs or under-shrubs.

Leaves 2- or more-times as long as broad.

Leaves rounded or shortly pointed, dark-green above, pale grey-tomentose beneath ... 5. *G. salvifolia*.

Leaves narrowed gradually to the apex, green on both surfaces ... 6. *G. hirsuta*.

Leaves nearly as broad as long.

Mature leaves glabrous or nearly so; petioles very slender... 7. *G. populifolia*.

Mature leaves more or less hairy; petioles not slender.

Leaves 4-6 inches long, hard and rough above; petiole glandular ... 8. *G. sclerophylla*.

Leaves 1-4 inches long; petiole not glandular.

Petioles 3-7 inch long; peduncles very short ... 9. *G. villosa*.

Petioles 1-4 inch long; peduncles 5-12 inches long ... 10. *G. sapida*.

1. *GREWIA OPPOSITIFOLIA*, Roxb. *Fl. Ind.* II (1832) p. 583.—A small or medium-sized tree. Leaves 2-4 by 1-2-2-5 inches, ovate, acuminate, closely serrate, the teeth small, blunt, scabrid above, pubescent beneath, base rounded, not or slightly oblique, 3-nerved, petiole 1-3 inch long, stout, tomentose; stipules 2 inch long, linear-subulate, caducous. Flowers 1-8 together; peduncles solitary, leaf-opposed or exceptionally a few axillary, tomentose, 3-7 inch long; pedicels 3-7 inch long, pubescent; buds ovoid-oblong, densely stellate-pubescent. Sepals 4-6 inch long, linear-oblong, 8-ribbed, red inside. Petals shorter than the sepals, linear, claw distinct, white or pale yellow. Fruit 1-4-lobed, each lobe about 3 inch diameter, black when ripe. Collett, *Fl. Siml.*, fig. 20. Vern. *dhaman*, *biul*.

Sub-Himalayan tract and hot valleys of the Himalaya ascending to 6,000 feet on the outer slopes. Salt Range. Trans-Indus. Moist districts near the hills. Gurdaspur, Hoshiarpur. Often cultivated by villagers and lopped for fodder. The bast fibre is used for ropes. The tree reaches 20-40 feet in height and 6 feet in girth, the bark is pale ash-colored, smooth. The wood is tough and is excellent for axe-handles, oars, banghy-poles, etc. It has an unpleasant smell when fresh and also when burnt. Like all *Grewias* this species varies somewhat, the leaves on sterile shoots being sometimes 6 by 3-5 inches and the petiole 5 inch long, but it is easily recognised by the peduncle being opposite to the leaf (which suggested the specific name; the leaves are

not opposite but alternate). The larger leaves and stout petioles distinguish it from *G. populifolia* which also has the peduncle opposite the petioles but is a shrub. Flowers: April—August.

2. *GREWIA LEVIGATA*, Vahl, *Symb. I* (1790) p. 34.—A small tree, bark dark-brown, thin. Leaves 3-7 by 1·2-2·5 inches, elliptic-oblong or -lanceolate, long-acuminate, serrate, base narrowed, 3-nerved, thin, nearly glabrous above, slightly stellate beneath; petiole ·2-·3 inch long; stipules ·2 inch long, linear-lanceolate. Flowers white, 2-6 on each peduncle; peduncles axillary, solitary or 2-3 together, slender, ·7-1 inch long; pedicels ·5-·7 inch long, buds ellipsoid, ribbed, tomentose. Sepals ·5-·6 inch long, oblong, 3-nerved. Petals less than one-third the length of the sepals, blade very small, claw distinct. Fruit 1-4-lobed, lobes ·25 inch across, connate in pairs when four are developed, black when ripe. Brandis, Ind. Trees, fig. 47. Vern. *Dhamani* (Kangra).

Sub-Himalayan tract from the Ravi eastwards. Common in moist shady ravines. This tree is nearly if not quite evergreen, the leaves being renewed in April. The leaves are lopped for fodder. Towards the base of the leaves the teeth are converted into small cup-shaped glands which appear to be characteristic. Easily recognised by its long-acuminate narrow leaves. Flowers: July—October.

3. *GREWIA ELASTICA*, Royle, *Illustr. Bot. Himal.* (1839) p. 104, *tab.* 22.—A small tree, young shoots tomentose. Leaves variable, 2-7 inches long or longer on vigorous shoots, ovate, elliptic or somewhat oblong, gradually or abruptly acuminate, serrulate, base rounded or slightly cordate, usually very oblique, 5-7-nerved, slightly rough and stellate on the veins above, densely softly grey-pubescent beneath or only slightly pubescent on the nerves and green beneath; petiole ·2-·5 inch long, stout, tomentose; stipules ·3-·4 inch long, linear. Flowers yellow; peduncles 1-5-together, axillary, usually 2-4-flowered, villous, ·3-1·3 inches long; pedicels ·2-·4 inch long, villous; buds globose or shortly oblong, very villous. Sepals ·25-·4 inch long, elliptic or oblong. Petals nearly half as long as the sepals, linear-oblong, claw distinct or 0. Fruit ·25 inch diameter, globose or indistinctly lobed. *G. leptopetala*, Brandis, Ind. Trees, fig. 49. Vern. *dhaman*.

Sub-Himalayan tract and valleys in the Himalaya ascending to 3,500 feet from the Indus eastwards. Salt Range. A very variable plant of which two forms are distinct at times but pass into one another:—

Var. ELASTICA proper.—Leaves very tomentose remaining white beneath.

Var. VESTITA (*Sp. Wall.*)—Leaves more glabrous, when mature green beneath.

G. leptopetala, Brandis, is a form without claws to the petals. The wood is grey, hard and close-grained, tough and elastic. It is excellent for shoulder-poles, spear-handles, &c. The bark yields a strong fibre and the leaves are lopped for fodder. Flowers: April—June.

4. *GREWIA SUBINAEQUALIS*, DC. *Prodr.* I (1824) p. 511.—A small or medium-sized tree, bark grey or greenish. Leaves 3-8 inches long, broadly ovate or suborbicular, acute or shortly acuminate, bluntly serrate, base cordate or sometimes truncate, 5-7-nerved, glabrous except on the nerves above when mature, brown-pubescent or tomentose beneath; petiole .4-.8 inch long, stout, tomentose; stipules .3-.4 inch long, linear. Flowers yellow; peduncles .3-.8 inch long, 1-5 together in the leaf-axils, rather stout, tomentose, mostly 2-4-flowered; pedicels .1-.4 inch long; buds obovoid or oblong, ribbed, tomentose. Sepals .3 inch long, oblong. Petals more than half the length of the sepals, claw distinct. Fruit .3 inch long, 1-2-lobed, hairy. Fl. Brit. Ind. under *G. asiatica*, Linn. Vern. *Dhaman*.

Sub-Himalayan tract from the Indus eastwards ascending to 3,000 feet. Not common. Probably also cultivated. This plant is perhaps the wild form of *G. asiatica*, Linn. (q. v.). It is closely allied to *G. sapida*, but may be distinguished by the leaves being usually rather deeply cordate (they are never rounded at the base and never oblong as is usually the case with *G. elastica*), the petioles are usually longer, the margin of the leaf almost coarsely toothed, not finely serrulate, and the buds are ribbed. Flowers: April—August.

5. *GREWIA SALVIFOLIA*, Heyne, ex Roth, *Nov. Pl. Sp.* (1821) p. 239.—A shrub 6-12 feet high. Leaves 1.5-3.5 by .6-1.1 inches, elliptic-oblong or oblong-lanceolate, very finely serrulate, base rounded, slightly oblique, 3-nerved, dark-green and glabrous or nearly so above, densely clothed beneath with short grey tomentum; petiole .2-.3 inch long, rather stout, tomentose; stipules .2 inch long, linear-subulate, hoary-tomentose. Flowers yellow, 2-3 together; peduncles axillary, solitary or sometimes 2-3 together, .1-.5 inch long; pedicels .2-.4 inch long, hoary-tomentose; buds ovoid-oblong, ribbed. Sepals .3-.4 inch long, linear-oblong, stellate-tomentose outside, glabrous within. Petals .2 inch long, oblong, claw distinct. Fruit 1-2-(rarely more-) lobed, each lobe .25 inch diameter, sparsely stellate.

Salt Range, Kala-Chitta. Frequent on the hills Trans-Indus and in Rajputana and probably occurs in the S. E. Punjab. A very distinct species easily recognised from its leaves. Flowers: July—September.

6. *GREWIA HIRSUTA*, Vahl, *Symb.* I (1790) p. 34, var. *HELICTERIFOLIA* (Wall. sp.).—A shrub 1-3 feet high, branches slender. Leaves 2.4-5 by .3-1 inch, oblong or linear-lanceolate, narrowed gradually to the apex, serrate, the teeth blunt, small, often irregular in size, base rounded, 3-nerved, clothed with very small stellate hairs above, densely stellate-pubescent beneath; petiole .1-.15 inch long, stout, hairy; stipules .1 inch long, linear-subulate, hairy. Flowers white turning yellow,

male and bisexual, 2-4 together; peduncles axillary, solitary or sometimes paired, .2-1 inch long, slender; pedicels .15-.4 inch long; buds ovoid, densely hairy. Sepals .2 inch long, oblong, tomentose outside. Petals .12 inch long, oblong, claw distinct. Fruit .3-.4 inch diameter, more or less 2-4-lobed, shining, brown, with scattered hairs and a ring of hairs at the top of the androgynophore. *G. polygama*, Masters, in Fl. Brit. Ind. (? Roxb.).

Sub-Himalayan tract ascending to 4,500 feet from the Indus eastwards. Salt Range. Apparently not common but has been collected at Karappa, (Hazara?). The typical *Grewia hirsuta* does not occur in the Punjab; it has broader leaves than var. *helicterifolia* and is sometimes very like *Grewia flavesceens*, Juss. (*G. pilosa*, Masters, in Fl. Brit. Ind.) *G. flavesceens*, Juss., is very common on dry hills in Jaipur State, Rajputana and probably occurs on the hills in the S.-E. Punjab; it has ovate-lanceolate leaves and angular stems which when old are deeply fluted or winged. The fruits of *G. hirsuta*, var. *helicterifolia*, are according to Haines pleasant eating and given in diarrhoea and dysentery. Flowers: July—October.

7. *GREWIA POPULIFOLIA*, Vahl, *Symb.* I (1790) p. 33.—An erect shrub 2-6 feet high, branches slender. Leaves .5-1.5 by .4-1.3 inches, ovate, suborbicular or obovate, subacute or obtuse, coarsely dentate, base rounded, not oblique, 3-nerved, glabrous or nearly so when mature; petiole .1-.5 inch long, very slender, nearly glabrous when old; stipules .1 inch long, linear-subulate. Flowers white, solitary or 2-3 together; peduncles solitary, leaf-opposed, slender, .1-.5 inch long; pedicels .1-.3 inch long, rather stouter and more pubescent than the peduncle; buds ovoid-oblong, densely pubescent. Sepals .5-.7 inch long, linear-oblong. Petals shorter than the sepals, attached to the back of the claw, the apex usually notched. Fruit 2-4-lobed, each lobe .3 inch diameter, orange, shining, acid, edible. Brandis, Ind. Trees, fig. 46.

Dry parts of the Sub-Himalayan tract, Hazara, Rawalpindi and Kangra, also in the adjacent plains not common. Salt Range, Kala-Chitta and hills Trans-Indus, frequent. Hissar, Puillaur Plantation. The fruit is eaten. This species is distinct and easily recognized. Flowers: August.

8. *GREWIA SCLEROPHYLLA*, Roxb. *Hort. Beng.* (1814) p. 42.—A small shrub 5-6 feet high. Leaves 4-6 by 3-5 inches, broadly elliptic or suborbicular, often slightly lobed, irregularly serrate or denticulate, the larger teeth with thick glandular tips, base 3-5-nerved, scabrid above, stellate-pubescent beneath; petiole .2-.6 inch long, very stout, tomentose, with several pairs of large glands near the top and on the margin of the blade; stipules .2 inch long, subulate. Flowers white, large, 2-3 together on each peduncle; peduncles axillary, solitary or clustered, .5 inch long or less, stout, tomentose; pedicels .5 inch long or less, stout, tomentose; buds ovoid, ribbed. Sepals .5-.7 inch long, oblong, densely tomentose outside. Petals

nearly half as long as the sepals, obovate, claw distinct. Fruit .7-1 inch diameter, globose, not lobed, scabrid. *G. scabrophylla*, Roxb. Brandis Ind. Trees, fig. 48.

Sub-Himalayan tract near the Jumna. (E. M. Coventry.) I have seen no Punjab specimens. According to Kanjilal this species is apt to be mistaken for *Helicteres Isora*. The bark yields a strong white fibre and the fruit can be eaten. Flowers: March-June.

9. *GREWIA VILLOSA*, Willd. in *Ges. Naturf. Fr. Neue Schr.* IV (1803) p. 205.—A shrub 4-6 feet high. Leaves 1.5-3 inches long, orbicular, crenate-dentate, the teeth in young leaves with tufts of hairs at the tip, base cordate or rounded, 5-nerved, rough with stellate hairs and often rugose above, softly tomentose beneath; petiole .3-.7 inch long, clothed with long spreading hairs; stipules .4 inch long, ovate-oblong, foliaceous, often very silky. Flowers dull-yellow, in axillary or extra-axillary clusters; peduncles solitary, very short; pedicels .2-.3 inch long, 2-4 together; buds ellipsoid, pilose, sepals .2-.3 inch long, oblong-lanceolate, tomentose outside. Petals about half as long as the sepals, oblong-obovate, notched at the apex, claw distinct. Fruit .5 inch diameter, globose, tuberculate, with tufts of long hairs on the tubercles, edible.

Salt Range. Hills Trans-Indus. Rajputana. The Salt Range and Trans-Indus specimens differ somewhat to those from Rajputana in the leaves having a rounded or only slightly cordate base and being much less rugose. The plant has the habit of *G. sclerophylla* but the leaves are smaller and not so scabrid. Flowers: June—September.

10. *GREWIA SAPIDA*, Roxb. *Fl. Ind.* II (1832) p. 590.—An undershrub 1-3 feet high with annual or perennial shoots from a woody root-stock. Leaves 1-4 inches long, broadly ovate, obovate, elliptic or suborbicular, rounded or abruptly shortly acuminate or acute at the apex, serrate, the teeth blunt, regular or irregular, base rounded or sometimes subcordate or slightly narrowed, 5-7-nerved, nearly glabrous or slightly rough above, usually grey-pubescent beneath; petiole .1-.4 inch long, stout, tomentose; stipules .2-.4 inch long, linear-lanceolate. Flowers yellow; peduncles 1-5 together, axillary, usually 3-flowered, .5-1.2 inches long, hispid; pedicels .3-.5 inch long; buds obovoid, grey-pubescent. Sepals .3 inch long, oblanceolate. Petals .2 inch long, oblanceolate, claw distinct. Fruits .25 inch diameter, sometimes slightly lobed, edible.

Sub-Himalayan tract ascending to 3,500 feet from the Indus eastwards. A plant of grass-lands and undergrowth of open Chir forests. Has been collected in Hazara and Rawalpindi but not as yet between the Jhelum and Jumna. It is probably not uncommon but usually taken for a young specimen of one of the larger *Grewias*. This is one of the class of plants which Brandis supposes to have become permanently dwarfed by annual jungle fires, *vide* Indian Trees, p. xxii-xxiii. This explanation is I think hardly tenable, the dying back being more probably due in their case as in the case of other undershrubs to a portion of the year being unfavorable to growth. In the

case of *Grewia sapida* this portion of the year is the hot weather which happens to be the season in which fires are most frequent but with some plants such as *Lepedeza sericea* in some localities, the unfavorable season is the winter and the plant dies back at that season. Flowers: April–May.

GREWIA ASIATICA, Linn.—This plant is cultivated for its fruits and is not known in a wild state unless the wild plant is *G. subinaequalis*, DC. As seen in gardens it is a shrub 6-15 feet high thus approaching *G. sapida*. The leaves are rounded or only slightly cordate at the base and usually rather more coarsely toothed than in *G. subinaequalis*. The peduncles are often longer and always slender. The main reason for keeping it distinct from *G. subinaequalis* is the habit but it is possible that that is merely a matter of treatment as it is much cut back to promote fruiting. Vern. *phlusa*.

2. TRIUMFETTA, Linn.

(In honor of G. B. Triumfetti, an Italian botanical author of the 17th century.)

Herbs or undershrubs with stellate pubescence. Leaves serrate, often lobed. Flowers yellow, small, in dense cymes which are axillary or leaf-opposed or terminate the branches. Sepals 5, distinct. Petals 5 (rarely 0), glandular and ciliate at the base, stamens 5-10-indefinite, free, inserted on a glandular torus. Ovary 2-5-celled; ovules 2 in each cell; style filiform; stigma 2-5-toothed. Fruit subglobose, echinate or setose, indehiscent or separating into cocci. Seeds 1-2 in each cell, pendulous. **DISTRIB.** Species about 40; throughout the tropics.

Lower leaves more or less 3-5-lobed; spines of the capsule glabrous; stamens 8-15 ... 1. *T. rhomboidea*.

Leaves orbicular; spines of the capsule pubescent; stamens 15-25 ... 2. *T. rotundifolia*.

1. **TRIUMFETTA RHOMBOIDEA**, Jacquin, *Enum. Pl. Carib.* (1760) p. 22.—Herbaceous or shrubby, 2-5 feet high; branches slender, more or less pubescent with simple hairs. Leaves polymorphous; the lower 2-3 inches diameter, usually 3-lobed, irregularly serrate, clothed with simple and stellate hairs on both sides and with simple hairs on the nerves beneath, base cordate or cuneate; the upper usually unlobed; petioles up to 1.5 inches long, more or less hairy; stipules subulate. Flowers .25 inch across, yellow, in dense terminal and leaf-opposed cymes; buds oblong, apiculate; peduncles and pedicels very short; bracts subulate. Sepals oblong, hooded and apiculate at the apex. Petals obovate-oblong, shorter than the sepals, ciliate at the base, claws very short. Stamens 8-15. Fruit .2 inch diameter, globose or ovoid, white-tomentose between the glabrous hooked spines.

Probably occurs throughout the area ascending to 4,000 feet. The plant yields a good fibre. Flowers during the rains and in autumn.

2. **TRIUMFETTA ROTUNDIFOLIA**, Lamk. *Encyc. III* (1789) p. 421.—Shrubby with rough-herbaceous branches. Leaves

·7·1·5 inches diameter, orbicular, irregularly serrate, glabrescent above, softly grey-tomentose beneath, base rounded or cuneate; petioles ·5·1·5 inches long, tomentose; stipules subulate. Flowers ·25 inch across, yellow, in interrupted racemes; buds clavate, 5-pointed, grey-tomentose; peduncles and pedicels very short; bracts linear. Sepals linear-oblong, apiculate, stellately pubescent outside. Petals obovate, a little shorter than the sepals, ciliate at the base. Stamens 15-25. Fruit ·2 inch long, ovoid, pubescent, spines with dilated bases, hooked, pubescent or nearly glabrous.

Dry rocky ground in the South Punjab. Flowers during the rains.

The following species also occur. The first is described by Duthie and Cooke as herbaceous, by Haines as a shrub. All the *Triumfettas* are perhaps shrubby in favorable situations:—

TRIUMFETTA PILOSA Roth.—Leaves ovate-lanceolate or the lower 3-lobed. Stamens 10. Fruit excluding the spines ·25 inch diameter; spines ·25 inch long, hooked, hispid on their lower edges.

Throughout the area ascending to 5,000 feet.

TRIUMFETTA NEGLECTA.—Wight and Arn. Leaves rounded at the base 3-5-lobed; pubescent above, tomentose beneath, the upper narrowed at the ends. Stamens 5-10, filaments hairy on the back. Fruit ·2 inch long, ovoid, spines hooked, ciliate on their upper edges.

West to the Indus but not common.

3. CORCHORUS, Linn.

(From the Greek *korchoros*, a pot herb mentioned by Theophrastus and Pliny. **DISTRIB.** Species about 35; throughout the tropics.)

CORCHORUS ANTICORUS, Raensch. *Nom. ed.* 3 (1797) p. 158.—A small perennial with tortuous branches, very woody in dry places. Leaves ·25·75 by ·25·5 inch, roundish or elliptic, plicate, crenate-serrate, base 3-nerved; petioles ·5·1 inch long, very slender, stipules subulate. Flowers ·15 inch across, yellow, in small leaf-opposed cymes; peduncles short, stout; bracts lanceolate. Sepals 4-5, linear-oblong, apiculate. Petals 4-5, ·15 inch long, obovate-oblong, exceeding the sepals. Stamens 8-10. Capsule ·4·1·2 inches, long, cylindric, slender, often curved upwards, beaked, glabrous, 4-valved, not or scarcely septate between the seeds. Seeds minute, trigonous, black. Vern. *béphalli*.

The plains in dry places; fairly common. Used as fodder for camels. Flowers: September—October.

TILIA, Linn. (*The Lime tree*).—A genus of about 30 species of trees easily recognized by the large oblong bract which is attached for about half its length to the peduncle of the inflorescence and persists in fruit. The species are difficult to recognize as there are many forms and hybrids in cultivation. The commonest species in Europe are *T. cordata*, Mill., the *small-leaved lime*, with leaves glabrous except for tufts of hairs in the axils of the nerves beneath and *T. platyphyllos*, Scop. the *large-leaved lime*, with leaves hairy on the nerves beneath and bearded in their axils. The *common lime*, *T. vulgaris*, Hayne, is generally believed to be a hybrid of

the above two species. *T. vulgaris* was introduced by Mr. Baden-Powell and is growing well in Kulu. It does not suffer from snow-break as do most of the European and American trees which have been tried and natural seedlings spring up freely under the older trees at Monali. The lime is also growing well in Simla. The timber is of no value but the lime would probably be a good tree for villagers to plant and lop for fodder.

XVIII. LINACEÆ.

Herbs or shrubs. Leaves usually alternate, simple, entire, rarely crenate-serrate; stipules lateral, interpetiolar or wanting. Flowers regular, 2-sexual. Sepals 5, rarely 4, free or connate at the base, imbricate. Petals as many as the sepals, hypogynous or slightly perigynous, usually fugacious, often contorted. Stamens as many as the petals with as many interposed staminodes, or twice, rarely thrice as many, united at the base into a ring or short tube, anthers versatile. Disk usually of 5 glands adnate to the staminal-tube. Ovary free, entire, 3-5-celled; ovules 1-2 in each cell. Fruit capsular, septically splitting into as many or twice as many valves as there are cells to the ovary and leaving no axis, less frequently a drupe. **DISTRIB.** A small family scattered throughout the world.

REINWARDTIA, Dumort.

(In honor of K. Reinwardt, a Dutch botanist, 1773-1822, Director of the Botanic Garden at Leyden. The following is the only species.)

REINWARDTIA TRIGYNA, *Planch. in Hook. Lond. Journ. Bot.* VII (1848) p. 522.—A glabrous shrub 2-3 feet high, branches erect or prostrate and rooting. Leaves 1-4 inches long, elliptic-lanceolate or oblanceolate, acute, decurrent into a short petiole, entire or minutely crenate-serrate, glabrous, mucronate, pale beneath; stipules minute, subulate, caducous. Flowers mostly solitary and axillary, yellow, showy, about 1.5 inches across. Sepals 5, lanceolate, acute, .5-.6 inch long. Petals 5, contorted, obovate, cuneate, about 1 inch long. Stamens 5, connate at the base, hypogynous, with as many interposed staminodes, in some flowers shorter, in others longer than the style. Glands 2-3 adnate to the staminal-tube. Ovary 3-5-celled, cells 2-locellate; ovules one in each locellus; styles normally 3, free or connate at the base, sometimes 4, 5 or 7 of different lengths. Capsule globose, the size of a pea, shorter than the persistent sepals. *R. tetragyna*, *Planch. Collett, Fl. Siml.*, fig. 21., *Vern. Basant*.

All along the Himalaya from the Indus eastwards, also in the Salt Range and on the hills Trans-Indus. Common and conspicuous when in flower. Ascends to 6,000 feet and flowers from February to May, the flowers being at a little distance much like the English primrose. In Hazara it is abundant on dry hill-sides growing in crevices in the limestone rock which saves a few inches near the root from being browsed by goats; in this condition it flowers

very freely. In Kangra it is common on moist shady banks. In autumn the leaves assume a red or purple tint. For the variations found in the relative number and lengths of the styles *vide* Cooke, Flora of the Presidency of Bombay, vol. I, p. 156. Cultivated in gardens in the plains but not often.

XIX. MALPIGHIACEÆ.

Trees or shrubs, often climbing. Leaves (in the Indian genera) opposite, entire, glands often present on the petiole or blade near the base; stipules small or 0. Inflorescence axillary or terminal; pedicels jointed, usually 2-bracteolate. Flowers bisexual. Calyx usually 5-partite, segments imbricate, rarely valvate, one or more (never all) furnished with a large gland (eglandular in *Aspidopterys*). Petals 5, clawed or not, fimbriate or dentate. Disk obscure. Stamens 10, hypogynous or subperigynous, equal or unequal; filaments free or connate at the base. Ovary 3-celled; ovules solitary in each cell; styles 1-3, straight or curled. Fruit in the Indian genera, of one or more winged samaras. **DISTRIB.** A family represented mainly in Tropical South America, less frequent in Africa and Asia.

Style 1; calycine gland large; petals unequal 1. *Hiptage*.

Styles 3; calycine glands wanting; petals equal ... 2. *Aspidopterys*.

1. HIPTAGE, Gærtn.

(From the Greek *hiptamai*, I fly; referring to the winged seeds. **DISTRIB.** Species 8; Tropical Asia.)

HIPTAGE MADABLOTA, Gærtn. De Fruct. II (1791) p. 169, t. 116.—A large evergreen climbing shrub, twigs, young leaves and inflorescence hoary or adpressed silky-tomentose. Leaves opposite, 4-6 inches long, elliptic-lanceolate or oblong, acuminate, entire, glabrous, thick, two glands on the margin of the leaf near the base one on either side of the midrib, secondary nerves 4-6 pairs; petiole .2-.5 inch long; stipules 0. Flowers .75 inch across, showy, fragrant, in axillary erect racemes about as long as the leaves, usually forming terminal panicles. Calyx persistent, 5-partite, lobes oblong, obtuse; one large oblong gland adnate partly to one calyx lobe and partly to the pedicel. Petals 5, free, reflexed, .5 to .7 inch long, orbicular, clawed, fimbriate, the uppermost largest with a large yellow spot, the remainder white, turning buff-colored as they fade. Stamens 10, curved, shortly united at the base, all antheriferous, the lowest twice as long as the rest. Ovary 3-lobed, 3-celled; style long, usually 1 circinate in bud and two rudimentary; stigma terminal. Fruit of 1-3 samaras, each with 3 obovate or oblanceolate wings, one about 2 inches by .5 inch, two smaller about 1 by .2 inch.

Sub-Himalayan tract from the Indus eastwards, mainly in ravines. Cultivated in gardens in the plains. Flowers: March-April.

2. ASPIDOPTERYS, A. Juss.

(From the Greek *aspis*, *aspidos*, a shield, and *pteron*, a wing; referring to the fruits. DISTRIB. Species 15; Tropical Asia.)

ASPIDOPTERYS WALLICHII, Hook. f. in Fl. Brit. Ind. I (1874) p. 421.—A climbing shrub, with slender shoots, twigs lower surface of the leaves and inflorescence clothed with white tomentum. Leaves opposite, 4-7 inches long, eglandular, ovate, base cordate or rounded, acuminate, entire, glabrescent above, nerves 4-5 pairs; petiole .5-.7 inch long; stipules 0. Flowers .3 inch across, in long, lax, pendulous panicles. Calyx short, 5-partite, eglandular. Petals 5, equal, entire, not clawed, much exceeding the calyx, white or creamy. Stamens 10, equal, filaments very shortly connate at the base. Ovary 3-lobed, hispid, with long deciduous white hairs; styles 3, glabrous. Fruit of 1-3 samaras; wing orbicular-oblong, 1-1.5 inches long, with conspicuous nerves radiating from the oblong nut.

Sub-Himalayan tract from the Ravi eastwards. Flowers: July–September.

MALPIGHIA GLABRA, Linn.—A small evergreen tree or large shrub. Leaves opposite, 1-3 inches long, elliptic, narrowed at both ends, entire. Flowers .4 inch diameter, bright pink. Petals fimbriate. Fruit edible. *Barbados Cherry*.

Indigenous to Tropical America. Cultivated in Lahore but does not fruit. Flowers most of the year.

XX. ZYGOPHYLLACEÆ.

Herbs or shrubs, rarely trees, branches usually articulate, Leaves opposite, stipulate, 2-3-foliate or pinnate, epunctate; stipules twin, persistent, sometimes spiny. Peduncles usually 1-2 in the axils of the stipules, 1-flowered. Flowers bisexual, usually regular. Sepals usually 5, imbricate, connate at the base. Petals 4-5, rarely wanting. Disk usually present. Stamens as many as, or twice, rarely thrice, as many as the petals, inserted at the base of the disk. Ovary sessile or on a short gynophore, lobed or winged, usually 4-5-celled; style simple, angled or furrowed, terminal. Fruit coriaceous or crustaceous, of 2-10 cocci, or capsular and septicidally dehiscent. DISTRIB. Mainly tropical and sub-tropical.

FAGONIA, Linn.

(In honor of Mr. Fagon, archiater to Louis XIV, who was a great patron of botany. DISTRIB. Species 2-3; widely distributed.)

FAGONIA CRETICA, Linn. Sp. Pl. (1753) p. 386.—A small spiny undershrub with stiff branches often more or less prostrate. Twigs slender, terete, striate, glabrous, glandular. Leaves opposite, 1-3-foliate, about .5 by .1 inch, entire, linear

or elliptic, mucronate; petiole very variable, 0·1-2 inches long, sometimes leaflike; stipules transformed into sharp slender spines up to ·5 inch long, persistent and continuing growth long after the fall of the leaves. Flowers solitary, rose-colored, on peduncles 2-5 inch long, arising from between the stipules. Sepals 5, deciduous, imbricate, half as long as the petals. Petals ·25 inch long, spathulate with a marked claw. Disk short, inconspicuous. Stamens 10, inserted on the disk; filaments filiform, naked; anthers oblong. Ovary hairy, sessile, 5-angled, 5-celled, tapering into a 5-angled style; stigma simple. Fruit 2 inch long, of five 1-seeded cocci, glandular-pubescent, deeply 5-partite almost to the axis; cocci dehiscing along the ventral suture and separating from a horny endocarp. *F. arabica*, Linn. *F. Bruguierei*, DC. Fl. Brit. Ind., I, p. 425.

A very common plant in the plains of the Punjab on dry gravelly soil. Abundant in the Haripur Tahsil of Hazara. Flowers more or less all the year round.

XXI. GERANIACEÆ.

A family containing no trees or shrubs indigenous to the area dealt with but one cultivated plant requires mention.

AYERRHOA CARAMBOLA, Linn.—An evergreen tree. Leaves alternate, imparipinnate, exstipulate; leaflets 5-11, ovate, acuminate, subopposite or alternate, shortly petiolulate, the terminal one 2·5 inches long, the lateral decreasing in size towards the base of the leaf. Flowers small, pink, in axillary panicles or emerging from the branches. Sepals 5, imbricate. Petals 5, contorted, twice as long as the sepals, about ·15 inch long. Stamens 10, united at the base, 5 shorter without anthers or sometimes one or two of these longer and antheriferous. Disk 0. Ovary pubescent, 5-lobed, 5-celled, not beaked; styles 5, distinct; stigmas capitate; ovules numerous in each cell. Fruit yellow, ellipsoid, 3 inches long, with 5 prominent ridges. Seeds with a fleshy 2-lobed, lacerate arillus. Vern. *Kamrak*.

Cultivated for its fruits as far west as the Jhelum. Flowers: February to August. Fruits in the cold season. The fruit is usually very acid and is mostly eaten cooked. The juice can be used to take out iron-mold stains from linen.

XXII. RUTACEÆ.

Trees or shrubs, a few genera herbaceous, usually glandular and aromatic. Leaves usually alternate, simple or compound, exstipulate. Flowers regular, usually bisexual, in cymes or panicles. Calyx 4-5-lobed. Petals 4-5, hypogynous, valvate or imbricate. Stamens as many as, or twice as many as the petals, or numerous, filaments usually free, hypogynous; anthers 2-celled, opening inwards. Disk within the stamens, crenate or lobed, sometimes large and long. Ovary usually of 4-5 free or connate carpels; ovules usually 2 in each cell. Fruit a capsule, berry or drupe or of 1-4 capsular cocci. **DISTRIB. A**

large family of warm and temperate regions, especially in Australia and South Africa.

Armed.

- | | | |
|---------------------------------------|-----|-------------------------|
| Twigs prickly; leaves imparipinnate | ... | 1. <i>Zanthoxylum</i> . |
| Branches thorny; leaves imparipinnate | ... | 2. <i>Limonia</i> . |
| Branches thorny; leaves trifoliolate | ... | 3. <i>Egle</i> . |
| Branches thorny; leaves 1-foliolate | ... | 4. <i>Citrus</i> . |

Unarmed.

- | | | |
|---|-----|-----------------------|
| Leaves simple; stamens 5 | ... | 5. <i>Skimmia</i> . |
| Leaves 1-7-foliolate; stamens 8-10; style short, persistent | ... | 6. <i>Glycosmis</i> . |
| Leaflets 3-25; style long, deciduous | ... | 7. <i>Murraya</i> . |

1. *ZANTHOXYLUM*, Linn.

(From the Greek *xanthos*, yellow, and *xulon*, wood. **DISTRIB.** Species 140; tropical and subtropical.)

ZANTHOXYLUM ALATUM, *Roxb. Hort. Beng.* (1814) p. 72.—A shrub or small tree, armed on the branchlets, petioles and midrib with broad flattened prickles, those on the older branches usually with a conical corky base. Leaves alternate, imparipinnate, rachis usually winged. Leaflets 2-6 pairs, opposite and a terminal, 1·5-3 by ·4-1 inch, lanceolate, more or less serrate, sparsely pellucid-punctate, sessile. Flowers small, polygamous, yellow, in dense pubescent lateral panicles. Calyx-segments 6-8, acute, imbricate. Petals 0. Stamens 6-8, much exceeding the sepals, wanting in female flowers. Disk inconspicuous. Carpels 1-3, rarely more, rudimentary in male flowers, oblique, 1-celled, distinct; ovules 2 in each carpel; styles lateral, free; stigmas capitate. Fruit of 1-3, small, red, globose drupes, the size of a peppercorn, ultimately splitting into 2 valves and exposing the solitary black shining seed. Vern. *Timbar*, *timar*, *timru*.

Along the foot of the Himalaya from the Indus eastwards ascending to 5,000 feet. Also Trans-Indus. Usually in rather hot, dry places. Wood close-grained, hard, heavy, yellow. The branches are used for walking-sticks, the twigs as tooth-brushes, and the fruit as a remedy for tooth-ache. Flowers: March—April.

2. *LIMONIA*, Linn.

(From *Limuna*, the Persian name for the Citron. **DISTRIB.** Species 2-3; Tropical Asia.)

LIMONIA ACIDISSIMA, *Linn. Sp. Pl. ed. 2* (1762) p. 554.—A large shrub or small tree with pale corky bark, armed with sharp, rigid straight thorns ·5-1 inch long. Leaves alternate, pinnate, 3-6 inches long; petiole and rachis jointed, the former narrowly, the latter very broadly winged. Leaflets 5-9, the lateral opposite, 1-2 inches long, sessile, rhomboid-ovate to lanceolate, usually obtuse and notched at the tip, base cuneate, margins

crenulate, glabrous, gland-dotted. Flowers tetramerous, .3 inch across, white, fragrant, in umbelliform racemes, often with 1-2 leaves at the base. Peduncles solitary or 2-3 together; pedicels .2-.3 inch long. Calyx 4-partite, small. Petals elliptic or oblong, glandular, .25 inch long, twice the length of the calyx. Disk annular or columnar. Stamens 8, sub-equal, free, inserted round the disk. Ovary 4-celled; style short, thick, ultimately deciduous; ovules 1 in each cell. Berry .3-.4 inch diameter, globose, black when ripe, with 1-4 seeds in exceedingly acid pulp. Vern. *bilan*.

Sub-Himalayan tract from the Ravi eastwards, common, ascending to 4,000 feet. Wood very hard, yellowish-white, like box-wood for which it might be a useful substitute. Flowers: April—May. Fruit ripens in the cold season. Dr. Trimen has pointed out (Journ. Bot., xxvii, 182) that this plant should strictly speaking be called *Hesperethusa crenulata*, Roem.

3. *ÆGLE*, Correa.

(The classical name of one of the Hesperides; derived from the Greek *agle*, splendor. DISTRIB. Species 2-3; Tropical Asia and Africa.

ÆGLE MARMELOS, Corr. in Trans. Linn. Soc. V (1800) p. 223.—A small or medium-sized deciduous tree armed with straight sharp axillary thorns, 1 inch long. Leaves alternate, 3-foliate, rarely 5-foliate; petiole 1-2.5 inches long, terete. Leaflets 2-4 by 1-2.5 inches, ovate or ovate-lanceolate, crenate, acuminate, membranous, pellucid-punctate, the lateral opposite, subsessile, the terminal long-petioluled. Flowers greenish-white, sweet-scented, about 1 inch across, 2-sexual, in short axillary panicles. Calyx flat, pubescent 4-lobed; lobes rounded, sometimes obscure. Petals 4, spreading, oblong, thick, gland-dotted, much exceeding the sepals, imbricate. Stamens numerous; anthers elongate, apiculate; filaments free or fascicled, inserted round an inconspicuous disk. Ovary ovoid, cells 10-20; style terminal, short, deciduous; stigma capitate; ovules numerous, 2-seriate. Fruit 2-7 inches diameter, globose, grey or yellowish, rind woody. Seeds numerous, oblong, compressed, with a woolly mucous testa, embedded in orange colored sweet pulp. Vern. *Bael*, *bil*.

Sub-Himalayan tracts and outer hills ascending to 4,000 feet from the Jhelum eastwards. Often cultivated. Wood yellowish or greyish-white with a strong aromatic scent when fresh, hard and close-grained. The pulp of the unripe fruit is dried and used medicinally as a remedy for diarrhœa and dysentery. The ripe fruit is eaten and mixed with water to make a refreshing drink. The shells of the smaller fruits are used for snuff-boxes. The Bael produces root-suckers fairly freely. Flowers in April and May, the fruit ripening about a year later.

4. *CITRUS*, Linn.

(From the Greek name, *Kitron*.)

Evergreen trees or shrubs, usually armed with axillary thorns. Leaves alternate, simple; petiole often winged, jointed to the

blade. Flowers axillary, solitary, fascicled or in small cymes, white or pinkish, fragrant. Calyx cupular or urceolate, 3-5-fid. Petals 4-8, linear-oblong, thick, imbricate. Stamens 15-60; filaments variously connate, compressed at the base. Disk large, cupular or annular. Ovary many-celled; ovules 4-8 in each cell, 2-seriate; style stout, deciduous; stigma capitate. Berry globose or oblong, fleshy, many-celled; septa membranous, cellules replete with juice. Seeds sometimes containing 2 or more (up to 13) embryos. **DISTRIB.** Species 5 in Tropical Asia, 2 in Australia.

Young shoots and leaves glabrous.

Young shoots purple; fruit usually mammillate at the apex ... 1. *C. medica*.

Young shoots greenish-white; fruit not mammillate ... 2. *C. Aurantium*.

Young shoots and leaves beneath pubescent ... 3. *C. decumana*.

1. **CITRUS MEDICA**, *Linn. Sp. Pl.* (1753) p. 782.—A shrub or small tree. Young shoots glabrous, purple. Leaves 3-6 inches long, elliptic-ovate or ovate-lanceolate, usually obtuse, crenate-serrate; petiole naked or winged. Flowers white, usually tinged with red, .5-1 inch long, often unisexual; pedicels .3-.5 inch long, stout. Petals with large glandular dots. Stamens 25-55. Fruit globose or oblong, usually mammillate at the apex, yellow when ripe. Vern. *nimbu*, *mitha*.

Wild in the Kangra District though probably an escape. The following varieties are cultivated:

Var. 1. *Medica proper*—The Citron.—Leaves oblong. Petiole short margined or not. Fruit large, oblong or obovoid, mammilla obtuse, rind thick, very aromatic, pulp scanty, sub-acid.

Var. 2. *Limonum*—The Lemon.—Leaves ovate, petiole margined or winged. Fruit medium-sized, ovoid, yellow, mammillate, rind thin, pulp abundant, acid.

Var. 3. *Acida*—The Sour Lime of India. Leaves elliptic-oblong petiole more or less winged, much shorter than the blade. Racemes short, flowers small, petals usually 4. Fruit usually small, globose or ovoid, rind thick or thin, pulp pale, very acid.

Var. 4. *Limetta*—The Sweet Lime of India.—Petiole winged. Flowers small, white. Fruit globose or ovoid, shortly mammillate, rind with concave vesicles, thin, smooth, adhering to the pulp, juice abundant, sweet, not aromatic.

Var. 5. *Lumia* The Sweet Lemon.—Petiole margined. Flowers tinged with red. Fruit bright-yellow, ovoid-oblong, with a long curved mammilla; rind with convex vesicles, pulp sweet, not aromatic.

2. **CITRUS AURANTIUM**, *Linn. Sp. Pl.* (1753) p. 782.—A tree, rarely a shrub, young shoots glabrous, greenish-white. Leaves 3-6 inches long, elliptic or ovate, obtuse, acute or acuminate; petiole naked or winged, the wing often obovate and nearly

as large as the blade. Flowers 2-sexual, pure white. Stamens 20-30. Fruit globose, usually flattened at both ends, not mammillate, usually orange-colored. Vern. *Narengi*.

Cultivated in the plains and Sub-Himalayan tract.

Var. 1. Aurantium proper—*The Sweet Orange*.—Petiole naked or winged. Pulp sweet, yellow, rarely red.

Bonavia, Oranges and Lemons of India and Ceylon, recognises four races of sweet oranges, viz. (a) *Santar*, distinguished by its loose skin. This is largely grown round Delhi: (b) *Keonla* with a rough dark-coloured adherent rind. This is the common *Narengi*: (c) *The Malta Orange*, the orange commonly met with in Europe. This form was introduced into Gujranwala in 1852-56 by Colonel Clarke and the Gujranwala 'blood-oranges' are still famous throughout the Province. (d) *The Mandarin*. The true mandarin is apparently not cultivated in Northern India but a similar fruit supposed to be derived from some form of *Keonla* is grown. It is a small dark-colored orange with thin smooth polished rind, of little use for eating but makes a nice table decoration.

Var. 2. Bigaradia—*The Bitter or Seville Orange*.—Petiole usually winged. Flowers larger and more strongly scented than those of the sweet orange. Rind aromatic, very bitter, pulp sour. This is seldom cultivated in Northern India.

3. CITRUS DECUMANA, Murr. Syst. ed. 13 (1774) p. 580.—

A tree, young shoots more or less pubescent. Leaves large, 6-9 inches long, ovate-oblong, frequently emarginate, usually downy beneath; petiole broadly winged. Flowers large, white. Stamens 16-24. Fruit large, pale-yellow, globose or pyriform, rind thick, pulp from crimson to pale pink or yellow; vesicles distinct. Vern. *Chakotra*.

Cultivated. The *Pummelo* or *Shaddock*. Good varieties are grown in Bombay, the kinds grown in the Punjab being very inferior.

NOTE.—The above account of the genus is based on Sir Dietrich Brandis, Forest Flora of North-West and Central India, which has been used as the basis for the treatment of this genus in all Indian Floras published since 1874. As pointed out by Dr. Bonavia (l. c.) the characters mentioned for the distinction of the species are not reliable,—vide Lushington, Indian Forester, Vol. XXXVI, pp. 323-353.

5. SKIMMIA, Thunb.

(From *Skimmi*, a Japanese word signifying a harmful fruit. DISTRIB. Species 3; Himalaya, China and Japan.)

SKIMMIA LAUREOLA, Sieb. et Zucc. ex Walp. Rep. V (1845-46) p. 405.—A gregarious, evergreen, glabrous shrub, all parts strongly aromatic. Leaves crowded towards the ends of the branches, 3-6 by .8-1.5 inches, closely gland-dotted, oblong-lanceolate or oblanceolate, entire, acute or acuminate, thick, softly coriaceous, lateral nerves obscure; petiole .1-.3 inch long, stout, flattened above. Flowers .3-.5 inch across, yellow, polygamous, in compact, erect, terminal panicles, 1.5-2 inches long. Calyx 5-lobed, imbricate, persistent. Petals 5, oblong, obtuse, 3 to 4 times as long as the calyx. Stamens 5; filaments

stout, subulate, as long as the petals. Ovary ovoid, of 2-5 carpels (completely united in the female flowers, free above in the male flowers); ovules solitary in each cell. Fruit an ovoid drupe .5-.7 inch long, red when ripe, containing (1-) 2 (-8) stones. Collett, Fl. Siml., fig. 25. Vern. *Ner. Shāshra* (Bash.).

Himalaya from the Indus eastwards, common, 6,000-10,000 feet. Also Trans-Indus. Flowers: April—May, often again in the autumn; fruit: July—September. The leaves when crushed have a scent like that of the musk deer.

6. GLYCOSMIS, Correa.

(From the Greek *glukus*, sweet, and *osme*, scent. DISTRIB. Species 6; Indo-Malayan.)

GLYCOSMIS PENTAPHYLLA, *Correa*, in *Ann. Mus. Hist. Nat. VI* (1805) p. 386.—An evergreen unarmed shrub or small tree. Leaves alternate or sub-opposite, 3-5- (rarely 1- or 7-) foliate; leaflets variable in size and shape, usually 2-8 by .7-2 inches, oblong-lanceolate, obtuse, acute or acuminate, entire or crenulate, glabrous, base acute, gland-dotted, subsessile. Flowers white, pentamerous, bisexual, less than .5 inch across, fragrant, in erect axillary panicles 1-4 inches long; pedicels very short; bracts beneath the calyx, triangular. Calyx small, lobes imbricate, ovate-orbicular, margins membranous, ciliate, with a yellow-gland on the outside of each lobe close below the apex. Petals white, imbricate, very broadly obovate or suborbicular, margins membranous. Stamens 10, free, inserted round the disk; filaments flattened; anthers with a gland at the apex and sometimes a smaller dorsal gland. Ovary on a short thick disk, 2-5-celled, covered all over, as is the style, with mammillate glands; style short, thick, fleshy, persistent, not jointed to the ovary; ovules 1 in each cell. Berry globose, white, pink or bluish, .4 inch across.

Sub-Himalayan tract from the Sutlej eastwards in moist shady places. Cultivated in Lahore. Flowers more or less all the year round. This plant endures shade well; it is very common, forming an undergrowth in mango groves in parts of the United Provinces.

7. MURRAYA, Linn.

(In honor of J. A. Murray, a Swedish Botanist of the 17th century.)

Unarmed shrubs or small trees. Leaves alternate, imparipinnate; leaflets alternate, petioluled. Flowers pentamerous, bisexual. Petals 5, free, imbricate. Stamens 10, free, alternately long and short, filaments subulate. Disk more or less elongated. Ovary seated on the disk, 2-5 celled, narrowed into the style; ovules 1-2 in each cell; style elongate, at length deciduous; stigma capitate. Fruit a 1-2-seeded berry. DISTRIB. Species 4-5; Tropical Asia.

Leaflets 3-9; flowers few	...	1. <i>M. exotica</i> .
Leaflets 9-25; flowers numerous	...	2. <i>M. Kanigii</i> .

1. *MURRAYA EXOTICA*, Linn. *Mantiss.* II (1771) p. 563.—An evergreen shrub or small tree with grey corky bark, young parts pubescent. Leaves 4-7 inches long; petioles glabrous. Leaflets 3-9, .5-3 inches long, the terminal the largest, all ovate-elliptic or rhomboid, usually acuminate, entire, glabrous and shining, base acute oblique; petiolules .1-.2 inch long. Flowers 1 inch long, white, very fragrant, in short axillary or terminal corymbs or solitary. Calyx-lobes small, glandular, obtuse. Petals oblong-lanceolate, erect at the base, upper half spreading. Filaments linear. Ovary linear, 2-celled; style filiform. Berry .5-.7 inch long, oblong or ovoid, narrowed at both ends, smooth, 2-seeded, red when ripe. Brandis, Ind. Trees, fig. 54. *China Box*. Vern. *Nargan* (Ka.), *Thamgal* (Simla).

Sub-Himalayan tract from the Ravi eastwards. Very frequently cultivated in gardens. Wood white, close-grained resembling box-wood. Flowers more or less throughout the year.

2. *MURRAYA KÖENIGII*, Spreng. *Syst. Veg.* II (1825) p. 315.—A small tree or shrub, deciduous, bark dark-grey. Leaves up to 12 inches long, petioles pubescent; leaflets 9-25, usually 1.5 by .7 inch, ovate, rhomboid or lanceolate, acuminate, tip obtuse, notched or acute, base oblique, the lower leaflets often suborbicular or obovate, much smaller than the upper, all irregularly crenate-dentate, glabrous or nearly so above, pubescent beneath, sprinkled with black dots; petiolules .1-.2 inch long. Flowers .3-.5 inch long, white, in much-branched terminal, pedunculate, corymbose cymes. Calyx-lobes small, acute, pubescent. Petals linear-oblong, rounded at the apex, gland-dotted. Filaments dilated at the base. Ovary 2-celled. Fruit ovoid, .3 inch long, rough with glands, pink, purple and finally black when ripe. Vern. *gandhela*. *Curry leaf*.

Sub-Himalayan tract and adjacent plains from the Ravi eastwards. Very common in Kangra. The wood is hard and durable. The leaves have a foetid smell when fresh but are used to flavor curries for which purpose the plant is occasionally cultivated. Flowers: April-June; fruit ripens in July and August.

FERONIA ELEPHANTUM, Correa.—The *Elephant*- or *Wood-Apple*.—A moderate sized deciduous tree with leaves like *Limonia acidissima* and fruit like *Ægle Marmelos* is occasionally cultivated as far west as Lahore. Flowers: May.

ACHRONYCHIA BAUERI, Schott.—A small evergreen tree. Leaves opposite, 1-foliate, elliptic, about 3-4 by 1.5-2 inches. Flowers small, in axillary panicles. A native of Queensland. Occasionally cultivated in the plains. Lahore. Flowers: February-March.

CLAUSENA WAMPI, Blanco.—A small aromatic evergreen tree. Leaves alternate, imparipinnate. Leaflets 5-9, alternate, about 2-4 by 1-2 inches, ovate. Flowers in large terminal and axillary panicles. Fruit a globose drupe about .7 inch diameter, edible. Indigenous to China. Occasionally cultivated in the eastern portion of the Punjab for its fruit. Hoshiarpur. Vern. *Wampi*.

ATALANTIA MONOPHYLLA, Correa.—An evergreen shrub. Leaves alternate, 1-foliate, coriaceous, elliptic, entire, usually notched at the tip, 1-3 inches long. Flowers white, .3-.5 inch long, in axillary corymbs. Brandis, Ind. Trees, fig. 58. Indigenous to South India. Cultivated in Lahore. Flowers: October—November.

XXIII. SIMARUBACEÆ.

Trees or shrubs, usually with bitter bark. Leaves usually alternate, often very large, usually pinnate; stipules 0 or deciduous. Flowers usually 1-sexual, regular small. Calyx 3-5-lobed or -partite, valvate, or imbricate. Petals 3-5, rarely 0, hypogynous, valvate or imbricate. Stamens as many or twice as many as the petals, inserted at the base of the disk; filaments free, often with a scale at the base; anthers usually opening inwards. Ovary free, 1-6-celled; styles 2-5, free at the base and apex or at the base only or connate by the stigmas; ovules usually solitary in each cell. Fruit drupaceous, capsular or samaroid, usually of 2-6 distinct, 1-seeded carpels. **DISTRIB.** A small family found in most tropical and subtropical regions.

A small unarmed tree; leaves pinnate ... 1. *Picrasma*.

A small thorny tree; leaves bifoliate... ... 2. *Balanites*.

1. *PICRASMA*, Blume.

(From the Greek *pikrasmos*, bitterness; referring to the intensely bitter bark. **DISTRIB.** Species 6; tropical Asia, W. Indies and Brazil.)

PICRASMA QUASSIOIDES, Bennett, *Pl. Jav. Rar.* (1888) p. 198.—A large shrub or small tree, branches few, stout, usually with white specks, bark very bitter. Leaves imparipinnate, 9-15 inches long, pubescent. Leaflets 9-15, increasing in size from the base, the lateral opposite, up to 4 by 1.5 inches, ovate to lanceolate, long-acuminate, serrate, membranous, nearly glabrous when mature; petiolules of the lateral leaflets less than .1 inch long, of the terminal leaflet .5-1 inch long. Flowers green, .3 inch across, in axillary, corymbose, pubescent panicles 3-6 inches long. Calyx (4-) 5-lobed, segments small, imbricate. Petals (4-) 5, valvate, ovate or obovate, much enlarged and coriaceous in fruit. Stamens (4-) 5, not scaly, hairy, filaments thickened towards the base. Ovary of 3-5 distinct carpels, seated on a thick disk, styles free at the base and top, connate in the middle. Fruit of 3-5 rather membranous drupes .2-.3 inch diameter, black when ripe, each containing one seed.

Himalaya from the Chenab eastwards 4-8,000 feet; Chamba, Kulu, Bashahr; not recorded from Simla. Flowers: April—June.

2. *BALANITES*, Delile.

(From the Latin *balanus*, an acorn, *balanitis*, acorn-shaped; referring to the ovary half sunk in the disk. *DISTRIB.* Species 2; in the dry region from Northern Africa to India.)

BALANITES ROXBURGHII, *Planch. in Ann. Soc. Nat. sér.* 4, II (1854) p. 258.—A shrub or small evergreen tree, twigs pubescent or glabrous, green, armed with stout axillary thorns which often bear leaves and flowers. Leaves alternate, 2-foliate, petiole .1-.3 inch long; leaflets 1-2 by .5-1 inch, elliptic or obovate, entire, puberulous, coriaceous, lateral nerves obscure; petiolules up to .2 inch long, jointed to the petiole. Flowers small, greenish, fragrant, in axillary cymes or fascicles. Sepals 5, ovate, about .15 inch long, imbricate, deciduous velvety-pubescent. Petals obovate-oblong, slightly larger than the sepals, glabrous without, silky within, imbricate. Stamens 10, inserted in furrows at the base of the disk; filaments naked. Disk thick, cupular, with a 10-lobed, glandular margin. Ovary ovoid, silky, half immersed in the disk, 5-celled; ovule solitary in each cell; style short, conical; stigma minute. Fruit an ovoid drupe, 1.7-2.7 by 1.2-1.5 inches, on a short thick stalk, faintly 5-grooved, pale yellow when ripe, pulp .2 inch thick, with an offensive greasy smell, stone hard, fibrous. Vern. *Hingota*.

South East Punjab, Delhi. On deep clay soils, not on the rocky hills. The tree spreads by root-suckers and hence is often found growing gregariously in small patches. It is much browsed by goats which eat it down to the ground. Flowers: April and May. Fruit ripens in the cold season. The stones are hollowed out filled with gunpowder and used for crackers. Engler and Prantl, *Pflanzenfamilien*, V. 3, part 4, p. 355, unite this species with *B. aegyptiaca*, Delile, a plant which differs in having glabrous petals, and place the genus under *Zygophyllaceæ*.

The following genus is represented by two introduced plants:—

AILANTHUS, *Desf.*—From *ailanto*, the native name of one of the species in the Moluccas, Large trees. Leaves very large, alternate, imparipinnate. Flowers small, polygamous, bracteolate, in large axillary panicles. Calyx small, 5-fid, lobes imbricate. Petals 5, valvate, spreading, the edges bent inwards. Stamens 10 in the male, 2-3 in the bisexual, and 0 in the female flowers, inserted at the base of the disk; filaments short or filiform, without scales. Ovary 2-5-partite; ovules 1 in each cell; styles connate. Fruit of 1-5 samaras; wing flat or twisted, oblong; seed central. *DISTRIB.* Species 7; India, China, Japan and Australia.

AILANTHUS EXCELSA, *Roxb.*—A large deciduous tree. Leaves up to 2-3 feet long; leaflets coarsely toothed, not glandular. Petals glabrous. Filaments shorter than the anthers. Samara twisted at the base.

Cultivated in the East Punjab as far West as Lahore. In Lahore it is not easily grown as the seedlings are very susceptible to damp. Once established the growth is fast. Flowers: April and May. This tree does not produce rootsuckers.

AILANTHUS GLANDULOSA, Desf. A large deciduous tree producing abundant rootsuckers. Leaves up to 3 feet long; leaflets usually with 1-3 pairs of glandular teeth near the base. Petals woolly-tomentose inside. Filaments longer than the anthers. Samara twisted at the top.

Cultivated in the hills. Abbottabad. This plant has been tried several times in Lahore but without success. Even in Abbottabad seedlings suffer much during the first monsoon, but at 6,000 feet they are not affected. The growth is very fast and as the tree produces rootsuckers freely it may be found useful for afforestation works. It requires a loose porous soil.

XXIV. BURSERACEÆ.

Balsamiferous trees or shrubs. Leaves usually alternate imparipinnate, 3-foliate or rarely 1-foliate, without or rarely with stipules. Flowers usually small, racemose or paniced, 2-sexual or polygamous. Calyx 3-5-lobed. Petals 3-5, free rarely connate. Disk annular or cupular, usually conspicuous. Stamens as many as or twice as many as the petals, inserted at the base or margin of the disk, sometimes unequal, filaments usually free. Ovary free, usually 2-5-celled; ovules usually 2 in each cell, axile. Fruit drupaceous, containing 2-5 pyrenes, rarely dehiscent and pseudocapsular. **DISTRIB.** Tropical regions of both hemispheres.

Calyx small, open; fruit dehiscent ... 1. *Boswellia*.

Calyx urceolate; fruit indehiscent.

Unarmed; leaves pinnate ... 2. *Garuga*.

Armed; leaves 1-3-foliate ... 3. *Commiphora*.

1. *BOSWELLIA*, Roxb.

(In honor of Dr. J. Boswell of Edinburgh. **DISTRIB.** Species 10; from N. E. Africa to India.)

BOSWELLIA SERRATA, Roxb. ex Coleb. As. Res. IX (1807) p. 379, t. 5.—A moderate sized deciduous tree, bark smooth, greenish, ash-colored or yellowish, exfoliating in thin flakes. Leaves alternate, 8-15 inches long, exstipulate, imparipinnate, crowded towards the ends of the branches. Leaflets 17-31, opposite, 2-3 by 3-6 inch, sessile, inequilateral, crenate-serrate, very variable in size, shape and vestiture. Flowers appearing as a rule when the tree is leafless, white, fragrant, in axillary racemes shorter than the leaves. Calyx persistent, 5-toothed, lobes small, deltoid. Petals 5, erect, free, imbricate, 2 inch long. Stamens 10, inserted at the base of an annular crenate red disk, alternately long and short. Ovary sessile on the disk, 3-celled; style short grooved; ovules 2 in each cell. Fruit 5 inch long, trigonous, splitting into 3 valves, pyrenes heart-shaped. Vern. *Salar, Salai. Indian Olibanum tree.*

Sub-Himalayan tract near the Junna on dry hills. Common in Rajputana and may be expected on the hills in the South-East Punjab. Flowers: April and May. The tree coppices well and grows readily from cuttings. It thrives on hot dry rocky ground where few other trees will grow.

2. *GARUGA*, Roxb.

(From the Telegu name of *G. pinnata*. **DISTRIB.** Species 8-10; Tropical Asia, America and Australia.)

GARUGA PINNATA, *Roxb. Hort. Beng.* (1814) p. 33.—A large deciduous tree, bark grey, red inside, exfoliating in irregular scales. Young shoots pubescent. Leaves alternate, 6-18 inches long, imparipinnate, exstipulate. Leaflets 11-21, up to 4 by 1·5 inches, ovate or oblong-lanceolate, crenate, long-acuminate, oblique, pubescent when young; petiolules ·1-·2 inch long. Flowers yellow, polygamous, in much-branched axillary tomentose panicles 6-12 inches long, appearing with or before the leaves, crowded towards the ends of the shoots. Calyx campanulate, cleft nearly half-way down, ·25 inch long, tomentose outside, lobes 5, narrow-ovate, valvate. Petals 5, ·2 inch long, linear-oblong, tomentose outside, sparsely pubescent within, inserted on the calyx-tube beneath the margin of the disk. Disk thin, lining the calyx-tube, crenate. Stamens 10, equal, inserted in the calyx-tube at the margin of the disk, filaments slightly hairy. Ovary ovoid, sessile, 4-5-celled, tapering into a stout hairy style; ovules 2 in each cell. Fruit a black globose fleshy drupe ·5-·7 inch across, containing 1-3, usually 2 bony tubercled pyrenes. Vern. *Kharpat*.

Ambala Siwaliks. Flowers: April—May. The wood is perishable and not used. The acid drupes are edible. The tree can be easily propagated from cuttings. I have seen posts 10 feet long and 6 inches diameter take root and grow. It is cultivated in Lahore but suffers a good deal from frost.

3. *COMMIPHORA*, Jacq. (*Balsamedendron*, Kunth.)

(From the Greek, *kommi*, gum, and *phorein*, to bear. **DISTRIB.** Species about 63; Tropical Asia and Africa, mainly in desert tracts.)

COMMIPHORA MUKUL, *Engl. in DC. Monogr. Phan.* IV (1883) p. 12.—A shrub or dwarf tree, young parts glandular-pubescent, branches usually ending in a sharp thorn. Trunk knotty, the outer bark coming off in rough flakes, leaving an inner layer which is bright shining and peels off in thin rolls like paper. Leaves 1-3-foliate; leaflets up to 1·25 inches long, subsessile, obovate, serrate towards the rounded apex, entire towards the usually cuneate base, thin, smooth and shining, mostly on thick dwarf shoots; the lateral leaflets usually wanting, when present on vigorous shoots, smaller and narrower than the terminal. Flowers nearly sessile, in fascicles of 2-3, polygamous. Calyx campanulate, glandular, hairy, lobes 4-5, triangular, equalling the tube. Petals brownish-red, ligulate, recurved at the tips, nearly thrice the length of the calyx. Stamens 8-10, inserted on the margin of the disk, alternately long and short, half the length of the petals. Disk 8-10-lobed, the alternate sinuses deeper and in these are inserted the shorter stamens. Ovary

sessile, 3-(rarely 2- or 4-) celled; ovules 2 in each cell. Fruit red, .2-.3 inch diameter, ovoid, acute, the rind splitting irregularly into 2-4 valves, exposing the pulp in which the bony 2-celled pyrenes are embedded. *Balsamodendron Mukul*, Hook. f. Fl. Brit. Ind., Vol. I, p. 529.

S. E. Punjab, Tanki Hill, Gurgaon (Dist. Gaz., 1883-84, p. 17). I have seen no specimens from the Punjab but the plant is common across the border in Jaipur State. It gives a gum-resin, known in English as *Indian Bdellum* and in the vernacular as *Gugal*, which is used in native medicine.

BURSERIA SERRATA, *Colebr.* A large evergreen tree with imparipinnate leaves, 5-9 leaflets, petiolules about .5 inch long. Flowers as in *Garuqa* but smaller, in glabrous panicles, disk annular.

Cultivated in Lahore and does very well, seedlings spring up naturally in moist places. Brandis, Ind. Trees, fig. 62.

XXV. MELIACEÆ.

Trees or shrubs. Leaves alternate, exstipulate, usually pinnate. Flowers regular, usually bisexual, in terminal or axillary panicles. Calyx small, 4-6-cleft. Petals 4-6, free, rarely connate. Stamens usually twice as many as the petals, inserted outside the base of a hypogynous disk; filaments usually united into a tube. Disk sometimes wanting, usually annular or tubular. Ovary usually free, 2-5-celled; ovules 1-2 in each cell, rarely numerous; style simple. Fruit capsular, drupaceous or baccate. **DISTRIB.** A family widely distributed in both hemispheres, mainly tropical.

Fruit drupaceous.

Leaves pinnate ... 1. *Azadirachta*.

Leaves bi- or tri-pinnate ... 2. *Melia*.

Fruit capsular ... 3. *Cedrela*.

1. AZADIRACHTA, Adr. Juss.

(From the Persian *Azad-darakht*, the name of *Melia Azedarach*. **DISTRIB.** Species 1; believed to be indigenous to S. India and Upper Burma.)

AZADIRACHTA INDICA, *A. Juss. in Mem. Mus. Par. XIX* (1830) p. 221.—A large glabrous evergreen tree. Leaves pinnate, 8-15 inches long, crowded towards the ends of the branches. Leaflets 9-15, 1-3 by .5-1 inch, subopposite, obliquely lanceolate or falcate, acuminate, coarsely serrate, often somewhat lobed near the obtuse base, bright green and shining above, paler beneath; petiolules very short. Flowers .2 inch long, in branched, glabrous, axillary panicles shorter than the leaves. Calyx 5-fid, divided almost to the base; lobes rotund-ovate, puberulous, minutely ciliolate. Petals 5, spatulate-oblong, faintly puberulous outside, ciliolate. Staminal-tube glabrous, a little shorter than the petals, obconic,

toothed at the apex; anthers 10, opposite the teeth of the staminal-tube and within the tube, sessile, apiculate. Disk 0. Ovary glabrous, 3-celled; ovules 2 in each cell; stigma 3-toothed. Drupe .5-.7 inch long, ovoid-oblong, 1-celled, 1-seeded, greenish-yellow when ripe. *Melia Azadirachta*, Linn., Fl. Brit. Ind., Vol. I, p. 544. *Melia indica*, Brandis, Forest Flora. Vern. *Nim*. The *Nim* or *Margosa* tree.

Not indigenous to the Punjab but much planted in the East as far West as the Sutlej and less frequently to the Jhelum. The leaves are used for placing in boxes in which clothes are packed to keep off insects. Natural seedlings are frequent in the Phillaur plantation coming up under the shade of other trees. The *Nim* is not easy to grow with irrigation and it appears to dislike too much water. It is rather sensitive to frost and was much damaged in 1905 in Phillaur. Flowers: March—May. Fruit ripens July—August.

2. MELIA, Linn.

(From the Greek name for the Ash *Fraxinus*. DISTRIB. Species about 12; warmer parts of Asia and Australia.)

MELIA AZEDARACH, Linn. *Sp. Pl.* (1753) p. 384.—A moderate-sized deciduous tree, bark dark-grey, with long shallow vertical fissures. Leaves bi-, occasionally tri-pinnate, 9-18 inches long, pinnæ 3-4 pairs, more or less opposite. Leaflets 3-11, opposite or nearly so, .5-2 by .3-1 inch, ovate or lanceolate, glabrous, base slightly inequilateral, acuminate, serrate, sometimes lobed; petiolules 0-.3 inch long, that of the terminal leaflet sometimes longer. Flowers .3 inch long, fragrant, 2-sexual, petals lilac, staminal-tube purple, in long-peduncled axillary panicles shorter than the leaves. Calyx pubescent outside, 5-6-cleft almost to the base; lobes ovate-oblong, acute, ciliolate. Petals 5-6, much exceeding the calyx, free, linear-oblong, minutely pubescent, .3 inch long. Staminal tube .2-.3 inch long, apex toothed and slightly dilated; anthers 10-12, sessile within the staminal-tube at its apex, inserted between the teeth, apiculate. Disk annular. Ovary glabrous, 5-celled; ovules 2 in each cell; style cylindric, much exceeding the ovary; stigma capitate. Drupe .5 inch diameter, globose, 5-celled, 5-seeded or fewer- by abortion, yellow and plump when ripe becoming wrinkled and remaining on the tree long after ripening. Vern. *Bakāin*, *drek*.

Said to be indigenous to the Jhelum Valley but this is doubtful. Known in English as the *Persian Lilac*, *Bead Tree* or *Bastard Cedar*. Cultivated and frequently self-sown in the plains and hills up to 9,000 feet (Chini in Bashahr). It is often used as a roadside tree for which it is ill-suited, being too small to shade a wide road and though handsome when young soon becoming hollow and scraggy. It is usually seen as a cultivated tree though by no means uncommon in the forests along the base of the Himalaya. The timber is not good but is used as it is not readily attacked by insects. In Changa Manga it is common and owing to its rapid growth it is apt to suppress better species. It is much lopped for fodder. The stones of the fruit are used for necklaces and rosaries. Flowers: March—May. Fruit ripens in the cold season.

3. CEDRELA, Linn.

(From *Cedrus*, the Latin name of the cedar; referring to the aromatic wood.)

Trees with colored, scented wood. Leaves alternate, pinnate. Flowers bisexual, small, in terminal or subterminal panicles. Calyx short, 4-6 cleft. Petals 4-6, free, imbricate. Stamens 4-6, inserted on the top of the disk, sometimes alternating with staminodes. Ovary sessile on the disk, 5-celled, narrowed into the style; stigma discoidal; ovules 8-12 in each cell, biseriate. Fruit a capsule, opening from the top by 5 valves which ultimately fall away leaving the axis and cell-partitions as a pentagonal column of soft white pith. **DISTRIB.** Species 16; Asia, Australia and America.

Leaflets entire; panicles usually shorter than the leaves; seeds winged at both ends ... 1. *C. Toona*.

Leaflets usually serrate; panicles exceeding the leaves; seeds winged only at the apex ... 2. *C. serrata*.

1. CEDRELA TOONA, *Roxb. ex Rottl. et Willd. in Ges. Naturf. Fr. Neue Schr.* IV (1803) p. 198.—A large deciduous tree, bark smooth up to middle age, afterwards rough, exfoliating in irregular scales. Leaves 12-18 inches long, usually glabrous, usually paripinnate by the abortion of the terminal leaflet. Leaflets 8-30, opposite or alternate, 2-6 by .7-2.5 inches, lanceolate or ovate-lanceolate, acuminate, entire or slightly undulate, base oblique; petiolules .2-.5 inch long. Flowers honey-scented, cream-coloured, in drooping panicles usually shorter than the leaves. Calyx divided nearly to the base. Petals .2 inch long, ovate-oblong, subacute, ciliate. Stamens 5, staminodes 0. Capsule oblong, .7-1 inch long, seeds winged at both ends. *Toona ciliata*, Roem. *The Toon*. Vern. *Tūn*.

Sub-Himalayan tract from the Rawalpindi District eastwards. The Toon is frequently planted both in the lower hills and in the plains. In the plains it suffers from frost when young and also from a shoot boring moth, *Hypsipyla robusta*, Mo. The wood of the Toon is red, even-grained, soft, easily worked and does not warp or split, is durable and not eaten by white ants, consequently it is much in demand for furniture. In the Punjab it is not common as a wild tree except in Kangra. Efforts have been made from time to time to grow the Toon in Changa Manga but the results have not been satisfactory. The conditions evidently do not suit it and it suffers greatly from frost when young and from the twig-borer. Flowers: March—May. Fruit ripens June—July.

2. CEDRELA SERRATA, *Royle, Ill. Bot. Himal.* (1839) p. 144, tab. 25.—A moderate-sized deciduous tree, bark rough with regular longitudinal fissures. Leaves 15-20 inches long, on young trees up to 3 feet long, usually imparipinnate. Leaflets 13-29, opposite, 3-6 by 1-2 inches, elliptic-oblong or oblong-lanceolate, acutely and rather long acuminate, serrate, base oblique; petiolules .1-.5 inch long. Flowers foetid, pinkish,

occasionally hexamerous, in large drooping panicles 3-5 feet long. Calyx small, dentate. Petals elliptic-oblong, obtuse, glabrous. Stamens 5, alternating with 5 filamentous staminodes. Capsule ovoid, about 1 inch long, seeds winged at the upper end only. *Toona serrata*, Roem. Collett, Fl. Siml., fig. 26. *The Hill Toon*. Vern. *drawa, drawi*. (Haz. Rp.), *arl* (Ku, Bash.), *duri* (Ka).

Himalaya from the Indus eastwards; common, 4,000-8,000 feet. The Hill Toon is common in ravines often on broken rocky soil in places where there is subsoil moisture. The growth is fast when young but the tree does not reach a large girth. Young plants often remain unbranched for the first few years and have very long arching leaves giving them a palm-like appearance. The wood is useful for furniture but lighter than that of the common Toon. Flowers: May-June.

[C. De Candolle (Records of the Botanical Survey of India, Volume III, Part IV) considers *C. longifolia*, Wall. a good species, it is supposed to differ from *C. serrata*, Royle, in having no staminodes and has been found in Hazara. All the specimens of Hill Toon from the Punjab at Dehra Dun have staminodes, though they vary somewhat in size.]

CHUKRASSIA TABULARIS, A. Juss.—The *Chittagong wood* is cultivated in Lahore. It resembles *Cedrela* but is distinguished by the filaments of the stamens being united into a tube.

AMOORA ROHITUKA, Wight and Arn.—Filaments of the stamens united into a tube. Fruit a globose, coriaceous, 3-valved capsule. Cultivated in Delhi. In Lahore it suffers much from frost when young.

SWIETENIA MAHAGONI, Jacq.—The *Mahogany*.—An evergreen tree. Leaves pinnate. Filaments of the stamens united into a tube. Fruit a woody capsule 2 inches long. Cultivated rarely in the Punjab probably because it is not realized how hardy the tree is. A specimen in Lahore has not been injured at all by the ordinary winter frosts, whereas in Saharanpur the Mahogany are amongst the finest trees in the Botanic Garden.

SWIETENIA MACROPHYLLA, King.—Differs from the above in having larger leaves and fruits. Leaflets 3-5 inches long (in *S. Mahagoni* about 2 inches long). Cultivated in Delhi and Lahore.

XXVI. OLACACEÆ.

Trees or shrubs, rarely herbs, sometimes climbing. Leaves usually alternate, simple or lobed, exstipulate. Flowers cymose or racemose, rarely capitate, terminal, axillary or extra-axillary, regular, 2- or 1-sexual, sometimes diœcious. Calyx 4-5-toothed. Petals 3-6, free or more or less connate. Stamens 3-15, inserted with the petals and more or less adnate to them, filaments usually free. Disk hypogynous or perigynous, cup-shaped or wanting. Ovary free or half-inferior, 1-celled or imperfectly 2-3-5-celled; ovules 1-5, pendulous. Fruit drupaceous or dry and indehiscent, 1-(rarely 2-) celled, 1-(rarely 2-) seeded, free or more or less adnate to the calyx-tube and disk. **DISTRIB.** A small family in the tropics of both hemispheres.

OLAX, Linn.

(From the Greek *olax*, a furrow; how this applies to the plant is not known. **DISTRIB.** Species about 30; tropics of the Old World).

OLAX NANA, Wall. *Cat.* (1828) No. 6783.—A low under-shrub with woody rootstock throwing up during the rains twiggy ribbed green shoots. Leaves alternate, 1-2·5 by ·3-·6 inches, subsessile, oblong-lanceolate, entire, glabrous, deep green above, glaucous beneath, margins recurved. Flowers white, ·25 inch across, solitary, axillary; peduncles slender, ·25-·5 inch long. Calyx minute, cupular, accrescent. Petals 3, valvate, oblong-obovate, rounded at the apex, cohering about half-way up but readily separable. Stamens 3, one in the centre of each petal, a little more than half its length and adnate to it; staminodes 6, one at the edge of each petal and a little shorter than it. Disk small, annular. Ovary ovoid; style shorter than the stamens. Fruit a globose drupe, ·25 inch across, apiculate, deep yellow when ripe, nearly covered by the accrescent calyx, 1-seeded.

Salt Range and Hoshiarpur Siwaliks. This is one of the class of plants which is supposed to have become dwarfed by periodic jungle fires like *Grewia sapida*, *Combretum nanum*, etc. (*vide* Brandis, *Indian Trees*, p. xxii-xxiii). Flowers: April—May.

XXVII. ILICACEÆ (Aquifoliaceæ),

Trees or shrubs. Leaves usually coriaceous and evergreen, alternate, simple; stipules minute or wanting. Flowers small, in axillary cymes, fascicles or umbels, usually diœcious. Calyx persistent, 3-6-cleft, lobes imbricate. Petals usually 4-5, free or connate at the base, imbricate, deciduous. Stamens as many as, and adhering to the base of the petals. Disk 0. Ovary free, 2-16-celled; style very short or 0; stigma capitate or discoid; ovules pendulous, 1-2 in each cell. Fruit a drupe with 2 or more, 1-seeded, free (rarely connate) stones. **DISTRIB.** A small family, mainly tropical.

ILEX, Linn.

(From the classical name of the Evergreen Oak, *Quercus Ilex*, which sometimes has holly-like leaves. Characters of the family. **DISTRIB.** Species over 200; mostly tropical.)

Leaves usually spinous-toothed; stones usually 2 ... 1. *I. dipyrrena*.
 Leaves regularly and closely serrate; stones usually 4 ... 2. *I. odorata*.
 Leaves entire; stones usually 5 3. *I. Doniana*.

1. **ILEX DIPYRENA**, Wall. *Pl. As. Rar.* III (1832) p. 68, t. 292.—A moderate-sized, evergreen tree, with light-grey smooth bark. Leaves 2-4 by ·7-1·5 inches, ovate, elliptic-lanceolate or lanceolate, usually with strong spinous teeth,

dull-green above, paler beneath, mucronate, very coriaceous, margins thickened and slightly recurved, midrib and petiole channelled above, the latter stout, .2 inch long. Flowers usually 2-sexual, .25 inch across, white, in axillary globose clusters; pedicels very short, stout, 2-bracteolate. Calyx 4-lobed, lobes broad, ovate, acute, ciliate. Petals 4, obovate, connate below, free in female flowers. Stamens inserted on the corolla, exceeding the petals. Ovary ovoid, 2-(rarely 3-4-) celled. Drupe .3 inch diameter, scarlet, globose with usually 2 stones. Collett., Fl. Siml., fig. 27. *The Himalayan Holly*. Vern. *Kanderu*.

Himalaya from the Indus eastwards, 5,000-8,000 feet, in moist ravines. Although the Himalayan Holly can be grown out of doors in Europe (*e. g.*, Kew) large trees were very badly damaged by frost in Hazara at 6,000 feet in 1905. The wood is hard and white but is not used. Flowers: April-June. Fruit ripens in the cold season and fruiting branches are much used by Europeans in and near the hills for Christmas decorations.

2. *Ilex odorata*, *Buch-Ham. in D. Don, Prodr. Fl. Nep.* (1825) p. 189.—A small evergreen tree. Leaves 4-8 by 1.5-2.5 inches, variable, from ovate to elliptic-lanceolate or elliptic-ob lanceolate, acuminate, regularly and closely serrate, thinly coriaceous, midrib and petiole channelled above, the latter about .5 inch long. Flowers 1-sexual, .15 inch across, white, the male in short paniced cymes, the female in globose sessile clusters; pedicels slender; bracts minute, at the base of the pedicels. Calyx 4-lobed, lobes rounded. Petals 4, oblong, obtuse, connate below in male flowers, free in female. Stamens inserted on the corolla, exceeding the petals. Ovary globose, 4-celled. Drupe .2 inch diameter, black, globose, with usually 4 stones.

Himalaya from the Sutlej eastwards, 3,000-4,500 feet, not common. Flowers: April.

3. *Ilex doniana*, *DC. Prodr. II* (1825) p. 644.—A medium-sized evergreen tree, young shoots and lower surfaces of young leaves pubescent. Leaves 2-4 by 1.25-2 inches, ovate or elliptic, acuminate, entire, rather thin, glabrous above and when mature also glabrous beneath, lateral nerves arcuate, midrib and petiole slightly channelled above, the latter slender, .5-1 inch long. Flowers 2-sexual, .15 inch across, greenish-white, in axillary umbels; peduncle .2-.5 inch long, stout, about 12-flowered; pedicels .2-.3 inch long. Calyx 4-5-lobed, lobes ovate, obtuse, ciliate. Petals 4-5, ovate-orbicular, crenulate, united at the base. Stamens inserted on and equalling the corolla; filaments dilated at the base. Ovary globose, 4-5-celled. Drupe .2 inch diameter, with 4-5 (usually 5) trigonous stones. *I. excelsa*, Wall. Fl. Brit. Ind. Vol. I, p. 603.

Occurs in the Kangra and Simla Districts at 4,600 feet but is rare. Flowers: May.

ILEX CASSINE, Walt.—A small glabrous evergreen tree. Leaves 2.5-4 by 1.3 inches, elliptic-oblong, entire or usually serrate with small distant irregular teeth, bright green and shining above, paler beneath. Cymes shortly peduncled, axillary, below the leaves or on short leafless branches.

Indigenous to the Southern United States. Cultivated in Lahore. Some Indian-grown specimens have the leaves rather smaller than described and somewhat oblanceolate.

XXVIII. CELASTRACEÆ.

Trees or shrubs, erect or climbing, sometimes armed. Leaves opposite or alternate, usually coriaceous, simple, never lobed, stipules small early deciduous or 0. Flowers small, bisexual or polygamous, usually cymose. Calyx small, 4-5-lobed or -partite, imbricate, persistent. Petals 4-5, rarely 0, spreading, imbricate, persistent. Stamens 3, 4 or 5, rarely 10, inserted on or under the edge of the disk, alternating with the petals. Disk large, lobed or entire, rarely 0. Ovary sessile on the disk, free or confluent with it, 2-5-celled; ovules usually 2 in each cell. Fruit a capsule, berry, drupe or samara; seeds usually arillate. **DISTRIB.** A small family of tropical and temperate regions.

Fruit a capsule.

Leaves opposite ... 1. *Euonymus*.

Leaves alternate.

A climber, unarmed, flowers racemose ... 2. *Celastrus*.

Erect, armed, flowers cymose ... 3. *Gymnosporia*.

Fruit a drupe ... 4. *Elæodendron*.

1. EUONYMUS, Linn.

(The classical name for plants of this genus.)

Trees or shrubs, rarely climbing, almost always glabrous. Leaves opposite, rarely alternate or whorled; stipules caducous. Inflorescence axillary, usually dichotomously cymose. Flowers bisexual, usually green, small. Calyx 4-5-lobed, lobes spreading or reflexed. Petals 4-5. Disk large, more or less 4-5-lobed. Stamens 4-5, inserted on the edge of the disk; anthers broad, 2-celled, both cells often dehiscing by a common slit. Ovary sunk in the disk, 4-5-celled; style short or 0; stigma small, 4-5-lobed; ovules usually 2 in each cell, attached to the inner angle, usually ascending. Fruit a capsule, 4-5-, or by abortion 3-, rarely 1-celled, lobed, angled or winged, rarely echinate; cells 1-2-seeded, loculicidal. Seeds more or less covered by a red or orange aril. **DISTRIB.** Species about 100; in the mountains of tropical Asia and the East Indies, a few scattered over Europe, North and Central America and 1 in Australia.

Erect trees, or shrubs, capsules not echinate.

Leaves evergreen, thick.

Leaves glossy, teeth sharp; capsules winged... 1. *E. pendulus*.

Leaves dull, teeth blunt; capsules lobed ... 2. *E. tingens*.

Leaves deciduous.

A tree, bark corky, pale-grey; capsules lobed 3. *E. Hamiltonianus*.

A shrub, bark smooth, dark-grey; capsules winged ... 4. *E. lacerus*.

A climbing shrub; capsules echinate ... 5. *E. echinatus*.

1. *EUONYMUS PENDULUS*, Wall. in Roxb. *Fl. Ind. ed. Carey*, II (1824) p. 406.—A small evergreen tree; bark dark, rather corky outside, yellow within; twigs pendulous, smooth. Leaves opposite, 3-5 by 1-1.5 inches, oblong-oblongeolate or oblong, narrowed at both ends, sharply serrate, glabrous, glossy-green above, paler beneath, coriaceous; petiole .3-.5 inch long, stout, channelled; stipules small, fimbriate. Flowers 4-merous, greenish-white, .3-.4 inch across, in dichotomous cymes which are more or less clustered at the tips or bases of the shoots, in the axils of small deciduous bracts. Peduncles 1-3 inches long, compressed; pedicels .2-.3 inch long. Calyx reflexed; lobes rounded. Petals ovate-oblong, white, fringed. Stamens slightly shorter than the petals. Style slightly shorter than the stamens. Capsule .3 inch long, winged, .6 inch across the wings. Seeds with a dark orange aril. Vern. *Tulli* (Haz.).

Himalaya 3-8,000 feet from the Indus eastwards, locally common. Flowers April to June. This tree was considerably damaged by frost in Hazara in 1905 but it can be grown out of doors near the sea in South England. The wood is fairly hard, even-grained and suitable for carving but is not used.

2. *EUONYMUS TINGENS*, Wall. in Roxb. *Fl. Ind. ed. Carey*, II (1824) p. 406.—A small evergreen tree; bark dark-colored, rather corky, yellow inside; twigs rough with minute tubercles. Leaves opposite, 1.3-3 by .7-1.3 inches, elliptic or ovate-lanceolate, acute or acuminate, serrate or crenate, glabrous, dull-green above, somewhat paler beneath, thick; petiole .2-.3 inch long; stipules fimbriate. Flowers 5-merous or sometimes 4-merous, greenish, .5 inch across, in axillary dichotomous cymes which are often clustered at the bases or tips of the shoots without subtending leaves. Peduncle .5-1.5 inches long, flattened; pedicels .3-.5 inch long. Calyx reflexed; lobes rounded, more or less fimbriate. Petals yellowish-white with dark veins, orbicular, crenulate. Stamens a little shorter than the petals; anthers purplish. Style slightly exceeding the stamens. Capsule .5 inch long, turbinate, lobed or obscurely angled. Seeds dark-brown, shining, half enclosed in an orange aril. Collett, *Fl. Siml.*, fig. 28.

Himalaya 6-10,000 feet from the Sutlej eastwards, common. Flowers April-June. This tree is sometimes planted near temples in Bashahr. The outer corky bark yields a yellow dye.

3. *EUONYMUS HAMILTONIANUS*, Wall. in Roxb. *Fl. Ind. ed. Carey*, II (1824) p. 403.—A deciduous tree, often flowering as a shrub; bark thick, grey, corky; twigs round, smooth. Leaves opposite, variable, 2·5-5 by 1-3 inches, usually elliptic or oblong, sometimes broadly ovate-elliptic, membranous or somewhat coriaceous when mature, glabrous, dull-green, finely and closely serrate, the teeth with deciduous cuspidate tips; petiole ·3-·5 inch long; stipules very slender, filiform. Flowers 4-merous, greenish-white, ·3 inch across, in di- or tri-chotomous cymes, which are axillary or in the axils of deciduous bracts and often crowded. Peduncle ·3-1 inch long; pedicels ·1-·3 inch long. Calyx reflexed; lobes rounded, entire; petals oblong, in flower with reflexed margins, entire. Stamens about half as long as the petals. Style as long as the stamens. Capsule ·3 inch long, turbinate, deeply lobed. Seeds brown, shining, enclosed in a scarlet aril. Vern. *siki* (Haz.).

Himalaya 4-9,000 feet from the Indus eastwards, mainly on the inner ranges, also Trans-Indus. Flowers: May—June. The wood is excellent for carving. When grown in the open it forms a small tree with short bole and dense rounded crown and reaches 4-6 feet in girth. Common in Hazara and much lopped for fodder.

4. *EUONYMUS LACERUS*, Buch-Ham. in D. Don, *Prodr. Fl. Nep.* (1825) p. 191.—A large deciduous shrub; bark smooth, dark-grey; twigs round, smooth. Leaves opposite, 1·5-4 inches long, ovate, elliptic or obovate, acuminate, thin, membranous, light-green above, paler beneath, glabrous, sharply doubly serrate, teeth prominent, close, fringing the edge of the leaf; petiole ·1-·3 inch long; stipules minute, filiform. Flowers 4-merous, greenish-white, ·2 inch across, in lax cymes crowded at the bases of the shoots. Peduncles ·5-2 inches long, slender, subumbellately branched at the top; pedicels ·1-·2 inch long, filiform. Calyx minute; lobes rounded, spreading. Petals ovate, entire, white. Anthers sessile on the disk. Style 0. Capsule ·4 inch long, winged, 1 inch across the wings, seeds grey, shining, minutely tubercled, enclosed in a scarlet aril. *E. fimbriatus*, Wall. *Fl. Brit. Ind. I.*, p. 611.

Himalaya 7-10,000 feet, common on the outer ranges as well as in Kagan Pangi and Kunawar. Flowers: April—August. Trans-Indus eastwards to Sikkim. A common plant as an undergrowth in deodar forests. It is often lopped for fodder.

5. *EUONYMUS ECHINATUS*, Wall. in Roxb. *Fl. Ind. ed. Carey*, II (1824) p. 410. An evergreen shrub, climbing over rocks and trees by means of adventitious roots; twigs longitudinally ribbed. Leaves opposite, 1-3 inches long, elliptic-lanceolate, serrulate, glabrous, thick, dark-green above, paler beneath; petiole ·1-·2 inch long, short, channelled; stipules minute. Flowers 4-

merous, greenish-white, .2 inch across, in axillary cymes. Peduncle .5-1 inch long; pedicels subumbellate, .1-.3 inch long. Calyx-lobes spreading, rounded, entire. Petals orbicular, white, minutely toothed. Stamens half as long as the petals. Style very large, thick. Capsule .3 inch across, globose, black, covered with short conical tubercles. Seeds dark-brown, shining, minutely pitted, enclosed in a scarlet aril.

Himalaya 7-9,000 feet from the Ravi eastwards; not common but has been collected at Dharmasala and in Bashahr. Flowers: April-June.

EUONYMUS JAPONICUS, Linn. f. An evergreen shrub, usually 4-8 feet high. Leaves opposite, 2-3 inches long, usually obovate with a rounded apex and more or less cuneate base, dark-green and glossy above, paler beneath, often variegated. Flowers greenish, .2-.3 inch across. Capsules globose, slightly lobed; seeds with a scarlet aril.

Native of China and Japan, cultivated in gardens in the plains and hills chiefly for its foliage. Flowers: May.

2. CELASTRUS, Linn.

(From *kelastros*, the Greek name for the Privet, *Ligustrum vulgare*.
DISTRIB. Species about 27; mainly in the mountains of S.-E. Asia, a few in Japan, Australia, N. America and the Pacific Islands.)

CELASTRUS PANICULATA, Willd. *Sp. Pl.* I (1797) p. 1125.—A large deciduous twining shrub, shoots rough and speckled with pale lenticels. Leaves alternate, 2.5-4 by 1.5-3 inches, broadly elliptic, ovate or obovate, abruptly short-acuminate, crenate-serrate, rather firm, glabrous, lateral nerves arching; petiole .3-.6 inch long; stipules minute. Flowers .15 inch across, greenish, unisexual, in terminal drooping panicles, 2-8 inches long. Calyx pubescent, 5-fid; lobes semi-orbicular, fringed. Petals 5, oblong, tips rounded. Stamens 5, inserted on the edge of the disk; filaments short, anthers oblong, very small in the female flowers. Disk concave, 5-lobed, larger in female than in male flowers. Ovary globose, glabrous seated on the disk, 3-celled, narrowed into a short stout style; stigma large, 3-lobed; ovules 2 in each cell; in male flowers, ovary rudimentary, subconical and slightly 3-toothed at the apex. Capsules .4-.5 inch across, 3-valved, 1-6-seeded; seeds completely enclosed in a scarlet aril. Brandis, *Ind. Trees*, fig. 74. Vern. *San-khiren* (Ka.)

Along the base of the Himalaya ascending to 4,000 feet from the Jhelum eastwards. Flowers: April-June. The seeds yield an oil of medicinal value.

3. GYMNOSPORA, Wight & Arn.

(From the Greek *gymnos*, naked, and *spora*, a seed; the seeds in some species being exarillate.)

Evergreen shrubs or small trees, often thorny. Leaves alternate, coriaceous, exstipulate. Flowers bisexual, small, greenish or yellow, in axillary solitary or fascicled cymes. Calyx 4-5-fid or partite. Petals 4-5, spreading. Stamens 4-5, inserted on the margin of or beneath the disk; anthers broad. Disk

broad, concave, lobed or sinuate. Ovary sunk into and confluent with the disk, 2-3-celled; ovules 2 in each cell; style short; stigmas 2-3. Capsule usually obovoid, 2-3-celled, 1-6-seeded. Seeds completely or half-covered by an aril or exarilate. **DISTRIB.** Over 60 species have been described but they are probably capable of considerable reduction. Dry hot parts of Asia, Africa, Australia and Malaya. less common in the Pacific and Mascarene Islands.

The genus is often united with *Celastrus* from which it differs in having the inflorescence cymose, ovary confluent with the disk and bisexual flowers.

A shrub; thorns slender; capsules .4 inch

long ...

1. *G. Royleana*.

A tree; thorns stout; capsules .2 inch long ...

2. *G. montana*.

1. **GYMNOSPORA ROYLEANA**, *Wall. Cat.* (1828) No. 4317.—A shrub 6-10 feet high, branches stiff, usually armed with straight thorns up to 1.2 inches long, sometimes unarmed. Leaves .5-2 inches long, ovate, elliptic or obovate, thick, glabrous, rather obscurely serrate; petiole thick, up to .2 inch long. Flowers .1 inch across, whitish, in subsessile, axillary, often fascicled cymes; pedicels slender, .1-.2 inch long; bracts minute. Calyx 5-fid, lobes rounded. Petals .07 inch long, oblong. Stamens two-thirds as long as the petals, filaments not dilated at the base. Disk 10-lobed. Ovary glabrous. Capsule turbinate, slightly lobed, .4 inch long, brown when ripe; seeds half-covered with an aril. *Celastrus spinosa*, Royle. Vern. *patāki*.

Himalaya ascending to 4,000 feet. Trans-Indus to Kumaon, Salt Range. Sub-Himalayan tract and Siwaliks. Common on hot dry slopes. Flowers: March—October.

2. **GYMNOSPORA MONTANA**, *Benth. Fl. Austral.* I (1863) p. 400.—A small tree, twigs long, rather slender, branches armed with stout thorns up to 1.5 inches long, the thorns often bearing flowers and leaves. Leaves 1-2 inches long, oblanceolate or spatulate, entire, narrowed into a petiole .1-.2 inch long. Flowers .15 inch across, whitish, in lax axillary, usually forked cymes; pedicels filiform, .1-.3 inch long; bracts minute. Flowers as in the above. Capsule globose, .2 inch long, purple when ripe, seeds dark-brown, shining 1-2 (-3) with or without an aril. *Celastrus senegalensis*, Lamk. Brandis, Ind. Trees, fig. 75

Dry rocky hills in the south-east Punjab; on the Ridge at Delhi. A small tree 15-20 feet high with a short bole 2-4 feet in girth and an oval crown. The wood is durable. The tree has a very wide distribution and is variable; the description applies to the forms found in the Punjab and Baluchistan. The tree would be worth trying for afforestation purposes in places such as the Pabbi. It flowers at various times of the year.

4. **ELÆODENDRON**, Jacq. f.

(From the Greek *elaia*, an olive, and *dendron*, a tree; the fruit is oily and of the shape of an olive. **DISTRIB.** Species 30; tropical Asia, America, Australia and South Africa. Under *Cassine*, Linn. in Engl. u. Prantl, Pflanzenfamilien.)

ELÆODENDRON GLAUCUM, Pers. Syn. I (1805) p. 241.—A small deciduous tree, bark nearly smooth, grey, twigs glabrous. Leaves opposite or sub-opposite, rarely alternate, 2-6 inches long, very variable, orbicular, ovate, elliptic or oblong, sub-coriaceous, glabrous, acute or acuminate, crenate-serrate or subentire, shining above, paler and more or less glaucous beneath; petiole .5-1 inch long, channelled; stipules small, deciduous. Flowers .3 inch across, green, 4-5-merous, in lax, axillary, dichotomous cymes longer or shorter than the leaves; pedicels slender, .3-.4 inch long; bracts small, ovate. Calyx divided nearly to the base, lobes unequal, orbicular; with membranous margins. Petals oblong, obtuse, with a large ovate thickening at the base. Stamens 4-5, inserted beneath the margin of the disk, about half as long as the petals, connective two-lobed at the top with a globose anther cell seated on each lobe. Disk thick, fleshy, sinuate. Ovary pyramidal, confluent with the disk 2-5-celled; style short, thick; stigma small, minutely lobed; ovules 2 in each cell. Fruit a yellowish-green drupe .3-.6 inch long, ovoid, apiculate, nearly dry, endocarp crustaceous, usually 1-seeded. Vern. *Marindu*, *mirgu* (Ka.).

Sub-Himalayan tracts from the Rawalpindi District eastwards. Flowers: February—June. A small tree with very open crown, not uncommon in forests of *Pinus longifolia*. Under cultivation it reaches a large size. (There is a form or perhaps a distinct species cultivated in Lahore. It is a handsome tree with a dense shady crown and has more succulent drupes. The flowers are identical with the wild form but the tree is distinguished at a glance by its denser crown. Both are growing in Saharanpur.)

XXIX. RHAMNACEÆ.

Shrubs or trees, erect or climbing, sometimes armed. Leaves alternate or opposite, simple, unlobed, usually stipulate; stipules small, deciduous or changed into spines. Flowers bisexual or polygamous, small, greenish, usually cymose. Calyx 4-6-fid; lobes short, triangular, usually keeled within, valvate. Petals 4-6 or 0, often clawed, usually very concave, usually equalling or shorter than the calyx-lobes. Stamens 4-6, inserted with and opposite to the petals, often enclosed within their folds; anthers usually 2-celled, versatile, dehiscing by longitudinal slits, cells and slits sometimes confluent. Disk fleshy and filling or thin and lining the calyx-tube, entire or lobed, sometimes hairy. Ovary sessile, free or immersed in the disk, free from or adnate to the calyx-tube, 3-(rarely 2-4-) celled; style short, usually 2-4-fid; ovules 1 in each cell, erect, anatropous. Fruit superior or inferior, drupaceous or capsular, the capsules sometimes winged. **DISTRIB.** A fairly-large family distributed over the temperate and tropical regions of the world.

Erect trees or shrubs (sometimes scrambling but not climbing by means of tendrils). Fruit superior.

Fruit drupaceous, stone 1-4-celled.

Leaves 3-5-nerved, stipules spiny ... 1. *Zizyphus*.

Leaves penniveined, stipules not spiny ... 2. *Berchemia*.

Fruit baccate, containing 2-4 pyrenes or cocci.

Disk thin, lining the calyx-tube ... 3. *Rhamnus*.

Disk fleshy, filling the calyx-tube.

An unarmed tree; peduncles axillary
fleshy in fruit ... 4. *Hovenia*.

Shrubs often armed; flowers sessile in
terminal and axillary spikes and panicles ... 5. *Sageretia*.

Shrubs climbing by tendrils. Fruit inferior,
capsular.

Leaves toothed; capsules winged ... 6. *Gouania*.

Leaves entire; capsules not winged ... 7. *Helinus*.

1. *ZIZYPHUS*, Juss.

(From *zizouf*, the Arabic name of *Z. sativa*).

Trees or shrubs, often decumbent or scrambling, usually armed with pairs of stipular spines, one usually recurved and the other straight. Leaves alternate, usually distichous, with 3 (-5) basal nerves. Flowers small, pentamerous; mostly bisexual, usually in axillary cymes. Calyx cup-shaped or broadly obconic, lobes keeled within. Petals hooded, usually deflexed, rarely wanting. Stamens enclosed by the petals and longer than them. Disk lining the calyx-tube, edges free, 5-10-lobed, flat or pitted. Ovary immersed in and confluent with the disk, 2-(4-) celled; styles 2 (-4), free or partly connate. Fruit a drupe, stone 1-4-celled, rugose or tuberculate, 1 seed in each cell. **DISTRIB.** Species 40; mostly Indo-Malayan, a few in West Asia, the Orient, Tropical and South Africa, Australia and Tropical America.

Leaves pubescent or tomentose. (See also *Z. Jujuba*, var. *hysudrica*).

Leaves velvety-tomentose beneath.

Leaves glabrous above; fruits usually 5-1
inch long, orange or red ... 1. *Z. Jujuba*.

Leaves pubescent above; fruits 3 inch
diameter, red or black ... 2. *Z. nummularia*.

Leaves not velvety beneath.

Leaves silky beneath; fruits 25 inch
diameter ... 3. *Z. Enoplia*.

Leaves pubescent not silky; fruits 7-1 inch
diameter ... 4. *Z. xylopyra*.

Leaves glabrous.

Leaves ovate-lanceolate, blunt, spines very
stout or wanting ... 5. *Z. sativa*.

Leaves acuminate, spines slender ... 6. *Z. oxyphylla*.

1. *ZIZYPHUS JUJUBA*, Lamk. *Encyc.* III (1789) p. 318.—A medium-sized tree or large shrub almost evergreen, branches usually spreading, drooping, twigs usually softly tomentose when young, spines usually in pairs, one straight, the other curved, sometimes more or less completely unarmed. Leaves .7-2.5 inches long, sub-orbicular to ovate-oblong, rounded at both ends, slightly unequal at the base, entire or serrulate, glabrous above, usually densely clothed beneath with white or buff tomentum, strongly 3-nerved; petiole .1-.6 inch long. Flowers .15 inch across, greenish-yellow, in sessile or shortly peduncled axillary cymes. Calyx pubescent or woolly without, glabrous within. Petals clawed, deflexed with the stamens between the calyx-lobes, lamina oblong. Stamens not exerted beyond the petals. Disk with ten grooved lobes. Styles 2, connate to the middle. Drupe .5-1 inch long, orange or red when ripe, globose or ovoid, stone tubercled and irregularly furrowed, usually 2-celled. Vern. *Bér*. Indian *Jujube*.

VAR. *HYSUDRICA*, Edgew.—A tree with ascending branches. Leaves often orbicular, glabrous or slightly pubescent beneath.

VAR. *FRUTICOSA*, Haines.—A small shrub 3-4 feet high, usually in gregarious patches. Fruit globose, .3-.5 inch diameter, yellow or red.

Along the foot of the Himalaya ascending to 6,000 feet and in the adjacent plains, Salt Range, etc. Cultivated and self-sown throughout the Punjab, very common. The *Jujube* or *Bér* tree, often reaches a considerable girth but the bole is short and the height growth not great. The tree is exceedingly variable, var. *hysudrica* being one of the best marked cultivated forms. In wild trees the fruit is usually globose but in cultivated forms ellipsoid and sometimes 2 inches long with a flavor resembling that of an apple but rather dry and with a tough thin skin. The *Bér* coppices well and yields a hard light reddish timber useful for agricultural implements. The growth is fast. The branches are used for fencing the leaves first being threshed out and given as fodder to camels or goats. Var. *fruticosa* is a common form in the Sub-Himalayan tract usually in grass-land and waste places where it forms dense gregarious patches. Gamble (Man., p. 181) suggests that if allowed to grow the plants in these patches will ultimately form trees but I have never seen them show any tendency to do so. It flowers and fruits regularly in this shrubby state and it seems probable that this form is a different species as suggested by Haines (Fl. Chota Nagpur, p. 270) Var. *fruticosa* closely resembles *Z. nummularia* and further observations in the field are necessary to give the exact distribution of the two. The best varieties of *Bér* are propagated by budding; the budded plants are much in demand by natives. Flowers: mainly July–September.

2. *ZIZYPHUS NUMMULARIA*, Wight & Arn. *Prodr.* (1834) p. 162.—A tomentose, bushy shrub, branches flexuous, divaricate at right angles, young twigs grey-pubescent or tomentose, spines in pairs, one straight slender very sharp, the other smaller much recurved. Leaves .3-1 inch long, elliptic or orbicular, more or less densely pubescent above, velvety-tomentose

beneath, entire or serrate, 3-nerved; petiole .1-.2 inch long. Flowers in axillary, sessile, pubescent cymes. Petals cuneate, longer than the stamens. Disk 10-lobed, with a pit opposite each lobe. Styles united to above the middle. Drupe .3 inch diameter, globose, red or black when ripe. Otherwise as for *Z. Jujuba*. *Z. rotundifolia*, Lamk. Brandis, Ind. Trees, fig. 78. Vern. *malla*.

Dry parts of the Punjab, common and often gregarious. Flowers: March—June. Branches used for fencing after the leaves have been threshed out and used for fodder. Fruit edible. Occasionally grows into a small tree 15 feet high with a stem 6 inches diameter.

3. *ZIZYPHUS CENOPLIA*, Mill. *Gard. Dict. ed.* 8 (1768) No. 3.—A shrub, often scrambling by means of its spines, branches rusty-tomentose when young, spines solitary or in pairs, one stout curved, the other more slender and straight, the straight spine often much reduced or wanting, sometimes unarmed. Leaves 1-2.5 inches long (smaller on young plants) ovate or ovate-lanceolate, oblique, acute or shortly acuminate, obscurely toothed or entire, pubescent or glabrous above, clothed with silky, adpressed, brown hairs beneath, 3-5-nerved; petiole .1-.3 inch long. Flowers in short, axillary, pubescent, subsessile cymes. Petals obovate, cuneate, shorter than the calyx-lobes, longer than the stamens. Disk with 10, short, deeply pitted lobes. Styles united almost to the top. Drupe .25 inch diameter, globose or ovoid, black, shining, pulp scanty, acid, edible; stone tubercled 1-(2-) celled. Brandis, Ind. Trees, fig. 79.

Sub-Himalayan tract from the Ravi eastwards, in hedges, etc., not common. Flowers: April—May.

4. *ZIZYPHUS XELOPYRA*, Willd. *Sp. Pl.* I (1797) p. 1104. A large straggling shrub or small deciduous tree, twigs rusty-tomentose, spines in pairs, rather small, one straight, the other curved, often wanting. Leaves 1-3.5 inches long, broadly elliptic, obovate or suborbicular, crenate-serrate, base oblique, often subcordate, pubescent on the nerves above, brown-pubescent beneath, 3-5-nerved; petiole .1-.3 inch long. Flowers sometimes 4-merous, in dense, axillary, pubescent, paniculate cymes; peduncle .2 inch long. Petals spatulate with long claws. Disk thin, 5-angled. Ovary usually 3-celled; styles 3, free almost to the base. Drupe .7-1 inch diameter, globose, densely grey-tomentose, dry and woody, stone large, thick furrowed, 3-celled, 3-seeded.

Sub-Himalayan tract from the Sutlej eastwards. Flowers: April—May. The fruit is not edible but is used to dye leather black. The bark is used for tanning.

5. *ZIZYPHUS SATIVA*, Gaertn. *De Fruct.* I (1788) p. 202.—A small deciduous tree, often shrubby, quite glabrous, branches

of young plants armed with very short spines, one straight, 1 inch long, the other much shorter, recurved, older trees usually unarmed, flowering shoots about 6-8 inches long, often fasciated on dwarf branches. Leaves 1-2 inches long, ovate-lanceolate, glabrous, crenate-serrate, oblique, 3-nerved; petiole .1-3 inch long. Flowers in few-flowered, axillary clusters. Petals clawed, tips truncate. Disk obscurely lobed. Styles 2, united to the middle. Drupe ellipsoid, .8 inch long, stone tuberculate. *Z. vulgaris*, Lamk. Fl. Brit. Ind. I., p. 633. Vern *Singli* (Haz.), *baryan* (Rp.)

Hazara 3-6,500 feet, common, also in Chamba. Cultivated and self-sown, probably not indigenous. Reaches a height of 20-30 feet, and a girth of 4-6 feet. Wood pale yellowish-brown, heartwood dark-brown. Much cultivated for its fruits and spreads readily by rootsuckers. Grows well on hot hillsides with loose stony soil and owing to its profuse suckers is excellent for fixing the banks of terraced fields. It would be worth trying for afforestation of hot dry slopes in the hills; suckers may be transplanted in the winter but apparently fail if moved in the rains. The fruit is an article of export in Hazara. The tree should be tried at low elevations in Kunawar. Flowers: June—July.

6. *ZIZYPHUS OXYPHYLLA*, Edgew. in Trans. Linn. Soc. XX (1846) p. 43.—An erect deciduous shrub, practically glabrous, spines slender, in pairs, one straight and one more or less curved. Leaves 1-2 inches long, ovate or ovate-lanceolate, usually acuminate, glabrous, serrate, base oblique, 3-nerved; petiole .2-.4 inch long, slender. Flowers in small, axillary, few-flowered, sessile clusters. Drupe .3 inch long, ovoid, acid, edible, orange when ripe, stone rugose, flattened, 2-1-celled, 2-1-seeded. Otherwise as for *Z. sativa*. Collett, Fl. Sinl., fig. 29. Vern *Phitni* (Haz.), *berari* (Ku).

Himalaya 2-6,000 feet from the Indus eastwards, common in open places, Salt Range. Flowers June—September.

2. *BERCHEMIA*, Neck.

(In honor of M. Berchem, a French botanist.)

Shrubs, usually climbing or small trees, mostly glabrous. Leaves alternate, entire or nearly so, with numerous prominent parallel, oblique secondary nerves. Flowers bi-sexual or polygamous, fasciated in the axils of the leaves or at the ends of the branches, or the fascicles arranged in axillary spikes or panicles. 5-, rarely 6-merous. Calyx-tube hemispheric or turbinate. Petals obovate or hooded. Disk lining the calyx-tube, margins free. Ovary sunk in the disk but not confluent with it, 2-celled. Style 2-fid. Drupe hard or fleshy, seated on the persistent calyx-tube; stone 2-celled, 2-seeded. DISTRIB. Species 10 in E. and S. E. Asia, 1 each in North America and E. Africa.

- | | |
|--|---------------------------|
| A large shrub; flowers in axillary panicles ... | 1. <i>B. floribunda</i> . |
| A small shrub; flowers in axillary fascicles ... | 2. <i>B. lineata</i> . |

1. *BERCHEMIA FLORIBUNDA*, Wall. Cat. (1828) No. 4256.—

A large shrub, erect or scrambling, twigs terete, glabrous. Leaves 2-4 inches long, elliptic or ovate-oblong, tip rounded or acuminate, base rounded or subcordate, glabrous, entire, paler or glaucous beneath, lateral nerves 10-12 pairs; petiole .5-.7 inch long; stipules on vigorous shoots, intra-axillary with free bases and tips. Flowers .1 inch across, very numerous, in fascicles arranged in a large terminal panicle, panicle-branches pubescent; pedicels .05-.1 inch long. Calyx .1 inch long, cleft half-way down; lobes 5, acute, slightly keeled at the tips within. Petals 5, folded round the stamens, shorter than the calyx-lobes. Stamens with the anthers exserted beyond the petals. Ovary conical; style short, thick; stigma small. Drupe .3-.4 inch long, ovate-oblong, purple, stone flattened, smooth.

Sub-Himalayan tract from the Indus eastwards ascending to 4,500 feet, not common. Flowers: July—September.

2. *BERCHEMIA LINEATA*, DC. Prodr. II (1825) p. 23.—A

deciduous shrub 3-5 feet high, twigs terete, glabrous, shining. Leaves variable in size, .2-1 inch long, suborbicular or ovate in the smaller forms, elliptic or ovate-oblong in the larger, glabrous, entire, pale or glaucous beneath, lateral nerves 5-8 pairs; petiole .1-.3 inch long; stipules free, linear, acuminate, as long as the petioles. Flowers 5-6-merous, .15 inch across, pale yellowish-green, in 2-3-flowered axillary clusters; pedicels .1 inch long. Calyx .1 inch long; lobes acute, much longer than the tube, keeled at the tips within. Petals as long as the stamens. Disk large. Drupe .25-.4 inch long, ovoid-cylindric, purple-blue. Otherwise as for *B. floribunda*. *B. Edgeworthii*, Laws. Fl. Brit. Ind. I., p. 638.

Himalaya 4,500-9,000 feet from the Indus eastwards, usually in shady places and on rocks. Common in the Kagin valley. Flowers: June—July.

3. *RHAMNUS*, Linn.

(The classical name of some spinous plant.)

Shrubs or trees, deciduous or evergreen. Leaves alternate (rarely opposite); stipules small, deciduous. Flowers bi-sexual or polygamous, 4-5-merous, cymose, the cymes fasciculate, rarely racemose. Calyx-tube cup-shaped, limb 4-5-fid, lobes keeled within. Petals inserted on the edge of the disk, sometimes wanting. Disk lining the calyx-tube, margin thin. Filaments short. Ovary free, ovoid, 3-4-celled, narrowed into a 3-4-fid style. Fruit baccate, supported by the persistent calyx-tube; pyrenes 2-4, dehiscent or not, 1-seeded. **DISTRIB.** Species about 70; mainly in North Temperate Regions.

Erect trees or shrubs.

Branches often ending in a thorn. Flowers 4-merous.

Leaves and branches alternate ... 1. *R. persicus*.

Leaves and branches opposite or sub-opposite 2. *R. virgatus*.

Unarmed. Flowers 5-merous.

Leaves membranous, shoots purple, cymes

sessile ... 3. *R. purpureus*.

Leaves subcoriaceous, shoots tomentose, cymes

racemed ... 4. *R. triquetra*.

Dwarf or procumbent shrubs.

Evergreen, unarmed ... 5. *R. procumbens*.

Deciduous, thorny ... 6. *R. sp.*

1. *RHAMNUS PERSICUS*, *Lawson, in Hook. f. Fl. Brit. Ind.* I (1875) p. 638, *ex parte*.—A deciduous shrub or small tree, bole short, branches stiff, often ending in a thorn, young shoots tomentose. Leaves alternate or fascicled on dwarf shoots, .5-2 inches long, oblong, elliptic-lanceolate or elliptic-oblong, acute or rounded at the apex, subcoriaceous, entire or obscurely serrate, when mature minutely tomentose on the nerves beneath; petiole .1-.3 inch long, tomentose. Flowers 4-merous, unisexual, green, in few-flowered, axillary clusters; pedicels .1-.2 inch long, slender, minutely tomentose. Calyx .1 inch long, lobes twice as long as the tube. Petals spatulate, minute or wanting. Stamens with dilated filaments, minute in female flowers. Disk hairy. Ovary rudimentary in male flowers; style slightly fid. Fruit .2 inch long, obovoid, supported by the flat circular calyx-tube; seeds 2-4, shining, grooved on the back, groove open, the edges thickened and bent inwards at the top.

Himalaya 2-5,000 feet. Salt Range. Trans-Indus to the Ganges in dry rocky places. Common in Hazara and Rawalpindi. This is not *R. persicus*, Boiss. *vide* the remarks under 6. *R. sp.* on page 90. Flowers with the leaves in March—April.

2. *RHAMNUS VIRGATUS*, *Roxb. Hort. Beng.* (1814) p. 17.—

A deciduous shrub or small tree, branches usually ending in a sharp slender thorn, young shoots minutely pubescent, branches with thin, smooth, shining bark. Leaves opposite or sub-opposite (fascicled on dwarf shoots), 1-4 inches long, variable, from narrowly elliptic-lanceolate to broadly ovate or obovate, thin, membranous, slightly puberulous on both surfaces, acuminate, base acute, crenate-serrate, lateral nerves arcuate, converging; petiole .2-.4 inch long, pubescent. Flowers 4-merous, unisexual, green, in many-flowered, axillary clusters; pedicels filiform .2-.3 inch long, pubescent or glabrous. Calyx .15 inch long, lobes longer than the tube. Filaments not dilated. Disk glabrous. Style deeply fid. Fruit .2 inch long, obovoid; seeds 2-4, dark-brown, shining, groove closed except at the lower end when the seed is ripe. Otherwise as for *R. persicus*. *R. dahuricus*, Pall. Fl. Brit. Ind., I., p. 639. Vern. *seta-paja* (Rp.)

Himalaya 2,500-9,000 feet, common between 5,000 and 8,000 feet from the Indus eastwards, also Trans-Indus. Flowers: April-June, with or just after the young leaves.

3. *RHAMNUS PURPUREUS*, *Edgew. in Trans. Linn. Soc. XX* (1846) p. 44.—A deciduous unarmed shrub, shoots minutely puberulous when young, at first green, afterwards purplish. Leaves alternate, 2-6 inches long, elliptic, elliptic-lanceolate or ovate, acuminate, thin, membranous, pubescent beneath when quite young, remaining bearded in the axils of the nerves otherwise glabrous, serrate, the teeth with deciduous tips, lateral nerves arching, prominent; petiole .3-.5 inch long. Flowers 5-merous, bi-sexual, green, in axillary clusters; pedicels .1-.4 inch long, minutely pubescent. Calyx .1 inch long, lobes equalling the tube. Petal 0. Filaments short. Disk glabrous. Style short, divided nearly to the base. Fruit .25 inch long, obovoid; seeds black, heart-shaped, with a shallow wide-open groove. Vern. *rangrek* (Bash).

Himalaya 6-10,000 from the Indus eastwards, also Trans-Indus. Fairly common in moist ravines, somewhat gregarious. Flowers: April-June, with the young leaves.

4. *RHAMNUS TRIQUETRA*, *Wall. in Roxb. Fl. Ind. ed. Carey*, II (1824) p. 376.—A small unarmed tree, shoots grey-tomentose when young, afterwards ashy-grey. Leaves 2-6 by 1-2.5 inches, elliptic-oblong or elliptic, subcoriaceous, glabrous above, minutely grey velvety tomentose beneath, crenate-serrate, the teeth with deciduous tips, apex acute, base usually rounded; petiole .3-1 inch long, tomentose, channelled above. Flowers .1 inch across, 5-merous, bi-sexual, green, in cymes which are arranged in axillary racemes 1-3 inches long, usually bearing a few small leaves; pedicels .1 inch long or less. Calyx .1 inch long, pubescent, lobes equalling the tube. Petals broadly obovate, emarginate, clawed. Stamens exceeding the petals. Disk glabrous. Style short; stigma minutely lobed. Fruit .2 inch long, 3-lobed, seeds 3, with a broad groove. Vern. *girgithan* (Ka.).

Himalaya and Sub-Himalayan tract from the Indus eastwards, Salt Range, Trans-Indus. Common. Flowers: July-August. Ascends to 6,000 feet. Gamble (Man., p. 186) says "a handsome wood of an olive-brown color, which would be useful for turning and small carving." The tree is however quite a small one.

5. *RHAMNUS PROCUMBENS*, *Edgew. in Trans. Linn. Soc. XX* (1846) p. 43.—A small evergreen prostrate shrub, young shoots pubescent. Leaves alternate, .3-1 inch long, elliptic, the smaller rounded at both ends, the larger narrowed at both ends, coriaceous, dark glossy green above, sharply serrate, teeth cuspidate, glabrous, midrib depressed above, prominent beneath; petiole .1 inch long; stipules subulate, persistent. Flowers .1 inch across, 5-merous, bi-sexual, green, axillary, usually solitary; pedicels .2-.3 inch long, filiform, minutely pubescent. Calyx-tube saucer-shaped, lobes exceeding the tube. Petals 0. Disk glabrous. Style short, thick, more or less 3-fid. Fruit

·2 inch long, black, shining ; seeds not grooved but with a broad flattened tubercle covering one side.

Himalaya 7-9,000 feet from the Sutlej eastwards. Flowers : May—July. A handsome little plant found on rocks, not common in the Punjab but occurs at Mathiana, on Shali and elsewhere in the Simla Hills.

6. *RHAMNUS* sp.—A dwarf rigid deciduous shrub, apparently only a few inches high, branches ending in stout sharp thorns. Leaves alternate, ·3-·4 by ·2-·3 inch, mostly clustered on dwarf shoots, elliptic, obtuse, obscurely serrate, glabrous ; petiole ·05 inch long, minutely pubescent. Flowers minute, solitary, axillary, 5-merous, green ; pedicels ·1 inch long, filiform. Calyx-tube saucer-shaped, lobes as long as the tube. Petals minute, oblong, notched at the apex. Disk glabrous. Stamens exceeding the petals. Style short, stout, minutely 3-fid. Fruit ·15 inch long, obovoid, black ; seeds brown, shining, minutely lacunose, with a broad shallow groove.

Himalaya 9,000-14,000 feet. Afghanistan to Kumaon. "Upper Chenab and Sutlej basins", Brandis, Forest Flora, p. 93. Apparently a dwarf alpine shrub. Flowers : May.

This is Aitchison's No. 915 = No. 7 Strachey and Winterbotham. It appears to be the true *R. persicus* of Boissier (= *R. curdicus*, Boiss. & Hoh.) not the plant described in the Fl. Brit. Ind., I, p. 638, as *R. persicus*.

4. *HOVENIA*, Thunb.

(In honor of David Hoven, a senator of Amsterdam. The following is the only species.)

HOVENIA DULCIS, Thunb. *Fl. Jap.* (1784) p. 101.—A small deciduous tree, shoots pubescent. Leaves alternate, 4-6 by 2-3·5 inches, ovate or elliptic, acuminate, base often unequal, 3-nerved, membranous, serrate, glabrescent above, hairy on the nerves beneath, lateral nerves 3-5 pairs, arching and anastomosing within the margin ; petiole ·5-1 inch long ; stipules lanceolate, deciduous. Flowers ·2 inch across, greenish-white in solitary or twin, axillary and terminal, pedunculate, many-flowered, dichotomous cymes, 1-3 inches long. Peduncles and branches rather stout, tomentose ; pedicels ·05 inch long, slender. Calyx-tube broadly obconic, lobes 5, acute, exceeding the tube. Petals 5, clawed, wrapped round but rather shorter than the stamens. Disk lining the calyx-tube, margins free, hairy. Ovary conic, sunk in the disk, 3-celled ; style 3-cleft. Fruit ·3 inch diameter, baccate, globose, supported by the persistent calyx-tube, 3-lobed, 3-celled, 3-seeded, the outer covering tough, separating from the inner membranous endocarp ; the peduncle and cyme-branches ultimately thickening, fleshy, edible, aromatic.

Chamba and Bashahr, not common, 3-6,500 feet. Flowers : April—June. Apparently not indigenous to the Punjab but originally introduced on account of its edible "fruit". Wild in Japan, China and possibly Nepal.

5. *SAGERETIA*, Brongn.

(In honor of A. Sageret, a French botanist of the nineteenth century.)

Shrubs, armed or not, sometimes scrambling. Leaves opposite or sub-opposite, stipules minute. Flowers small, bisexual, fascicled, the fascicles arranged in terminal and axillary spikes or panicles. Calyx 5-fid, lobes ovate, acute, keeled within. Petals 5, clawed, enclosing the stamens. Stamens 5, equalling the petals. Disk cup-shaped, filling the calyx-tube, margins free, obscurely 5-lobed. Ovary ovoid, sunk into but free from the disk, 3-celled; style short, 3-grooved; stigmas 3. Fruit baccate, globose, coriaceous, indehiscent, pyrenes normally 3. **DISTRIB.** Species 10; Central and East Asia, Java and the warmer parts of North America.

Lateral nerves prominent, 5-8 pairs, leaves 1·5-4 inches long ... 1. *S. oppositifolia*.
Lateral nerves not prominent, 3-4 pairs, leaves 3-2 inches long ... 2. *S. theezans*.

1. *SAGERETIA OPPOSITIFOLIA*, Brongn. in *Ann. Sc. Nat. sér. 1*, X (1827) p. 360.—A large shrub often scrambling, branches tomentose when young, often armed with short stiff thorny branches. Leaves 1·5-4 by ·7-1·5 inches, ovate-oblong, acute or acuminate, serrate, sometimes obscurely, clothed when young especially beneath, with deciduous woolly-tomentum, base rounded or subcordate, subcoriaceous; lateral nerves strongly impressed above, prominent beneath, 5-8 pairs; petiole ·2-·5 inch long; stipules minute, dark-brown. Flowers ·1 inch across, greenish-yellow, sessile, in terminal and axillary, tomentose panicles. Calyx-tube saucer-shaped, lobes exceeding the tube. Petals keeled on the back. Disk deeply cup-shaped. Fruit ·2-·3 inch long, obovoid, black when ripe, edible.

Along the foot of the Himalaya from the Indus eastwards ascending to 6,000 feet, not very common. Flowers at various seasons.

2. *SAGERETIA THEEZANS*, Brongn. in *Ann. Sc. Nat. sér. 1*, X (1827) p. 360.—An evergreen shrub 10-12 feet high or less, branches stiff, often ending in thorns. Leaves 3-2 inches long, elliptic or suborbicular, coriaceous or subcoriaceous, light- or dark-green above, serrate or almost entire; lateral nerves 3-4 pairs, the lowest pair basal; petiole up to ·2 inch long; stipules small, dark-brown. Flowers less than ·1 inch across, sessile, green, in axillary and terminal, interrupted spikes or panicles. Calyx saucer-shaped, lobes exceeding the tube. Petals obovate, emarginate. Fruit ·2 inch long, black, sweet, edible, seeds usually 3. Collett, *Fl. Siml.*, fig. 30. Vern. *ganger*, *kanger* (Rawalp.).

VAR. THEEZANS proper. Leaves glabrous or nearly so beneath, bright green.

VAR. *BRANDRETHIANA* (*sp. Aitch.*).—Leaves densely white velvety tomentose beneath, dark green above.

Sub-Himalayan tract from the Indus to the Jhelum, Salt Range, also in Kagan, Chamba and the Sutlej valley, ascending to 8,000 feet. As suggested by Brandis I do not think it possible to separate *S. theezans* and *Brandrethiana* though extreme forms are very distinct. *Var. theezans* proper occurs in Chamba and Bashahr; var. *Brandrethiana* in the Salt Range, Rawalpindi and the outer hills of Hazara. In the Kagan valley intermediate forms are found. Flowers at various seasons.

6. *GOUANIA*, Linn.

(In honor of Anthony Gouan, a professor of botany at Montpellier. *DISTRIB.* Species about 50; chiefly Brazilian.)

GOUANIA LEPTOSTACHYA, DC, *Prodr.* II (1825) p. 40.—A large shrub climbing by means of terminal tendrils, branches smooth, glabrous or nearly so. Leaves alternate, 2-4 by 1·5-2·5 inches, ovate, abruptly acuminate, base truncate or cordate, 3-nerved or 5-nerved by an additional smaller pair, more or less pubescent beneath when young, lateral nerves rather conspicuous, 4-5 pairs, arcuate; petiole ·3-·7 inch long, obscurely glandular at the top; stipules deltoid, often with persistent bases and deciduous tips. Flowers ·15 inch across, white, polygamous, fascicled, the fascicles arranged in axillary and terminal spike-like racemes, 6-10 inches long, often panicle at the ends of vigorous shoots. Rachis pubescent or tomentose; fascicles in the axils of deciduous, linear, acute bracts ·07 inch long; pedicels ·05 inch long. Calyx saucer-shaped, lobes 5 (-6) equaling the tube, keeled at the tips within. Petals 5 (-6), inserted below the margin of the disk, folded round the stamens. Stamens 5 (-6) inserted on the margin of the disk, not longer than the petals; filaments narrowed upwards. Disk glabrous, filling the calyx tube, the margin produced in front of each calyx-lobe into a horn-like process (apt to be taken for staminodes). Ovary inferior, sunk in the disk, 3-celled; style short, 3-fid; stigmas minute. Fruit capsular, ·5 inch long, 3-winged, dehiscent, tipped by the persistent calyx-tube; seeds 3, dark-brown, polished, obovate, ·15 inch long, the one or two inner facets concave, the outer convex.

Sub-Himalayan tract from the Kangra District eastwards. A conspicuous and rather ornamental plant when in flower. Flowers: August-September.

7. *HELINUS*, E. Meyer.

(From the Greek *helix*, a tendril. *DISTRIB.* Species 4; Africa, Madagascar and India.)

HELINUS LANCEOLATUS, Brandis, *For. Fl.* (1874) p. 574.—A slender unarmed, climbing shrub, climbing by means of terminal tendrils, branches ribbed, glabrous or the youngest slightly hairy. Leaves alternate, 1·5-3 by ·4-1·3 inches, smaller towards the ends of the shoots, lanceolate, entire, gradually nar-

rowed to a point, base rounded, 3-nerved, glabrous or nearly so, paler beneath; petiole .4 inch long or less, slender, hairy; stipules small, acute, dark-colored, ciliate. Flowers .2 inch across, greenish, in axillary umbellate cymes towards the ends of the branches. Peduncle .5-1 inch long, slender; pedicels filiform, .1-.3 inch long; bracts small, dark-colored, ciliate. Calyx-tube broadly obconic; lobes 5, equalling the tube, tips shortly acuminate, keeled within. Petals 5, inserted beneath the margin of the disk, folded round the stamens. Stamens 5, inserted beneath the margin of the disk, anthers exerted beyond the petals. Disk glabrous, filling the calyx-tube, margin thin, free, unlobed. Ovary sunk in the disk, inferior, 3-celled; styles short, 3-cleft; stigmas recurved. Fruit capsular, .2-.3 inch diameter, globose, inferior, ultimately dehiscent, 3-seeded; seeds .2 inch long, dark-brown, polished smooth.

Sub-Himalayan tract and Himalaya ascending to 4,000 feet from the Indus eastwards, Salt Range, Siwaliks; fairly common. Flowers more or less throughout the year.

XXX. VITACEÆ. (Ampelidaceæ.)

Climbing shrubs or small erect trees or shrubs, sometimes herbaceous, juice copious watery, stems and branches nodose. Leaves alternate, simple or variously compound, stipulate. Flowers regular, bi-sexual (rarely unisexual) usually small and greenish, in cymes, racemes, panicles or thyrses, inflorescence usually leaf-opposed; peduncles often transformed into simple or compound tendrils, the ultimate branches of which sometimes end in adhesive disks. Calyx small, entire or 4-5-toothed or -lobed. Petals 4-5, free or cohering, valvate. Stamens 4-5, opposite the petals, inserted at the base of the disk or between its lobes. Disk between the stamens and ovary, very various in form. Ovary sunk in the disk, 2-6-celled; ovules 1-2 in each cell, ascending, anatropous; style short or 0; stigma minute or discoid. Fruit baccate, 1-6-celled, cells 1-2-seeded. Seed erect, often rugulose. **DISTRIB.** A small family in the tropical and temperate regions of the world.

Climbing shrubs; stamens free, ovary 2-celled ... 1. *Vitis*.

Erect shrubs; stamens connate and adnate to the petals; ovary 3-6-celled ... 2. *Leca*.

1. VITIS, Linn.

(The Latin name of the vine.)

Climbing shrubs, usually with tendrils, very rarely erect. Leaves simple or compound, alternate; stipules membranous, deciduous. Flowers small, 4- or 5-merous, in umbellate, paniculate, racemose or spicate cymes, Calyx short, entire or

lobed. Petals free or cohering at the apex. Disk very variable. Ovary 2-celled; ovules 2 in each cell; style 0 or subulate. Berry ovoid or globose, 1-4-seeded. Seeds very variable in shape and sculpturing. **DISTRIB.** Species about 375; tropical and sub-tropical regions, less common in temperate regions.

The genus was monographed by Planchon in Volume V of De Candolle's *Monographiæ Phanerogamarum* and divided up into a number of genera. The species described below fall into the following genera of Planchon:—

- Vitis*.—Petals 5, cohering in a calyptra ... *Vitis parvifolia*, Roxb.
Vitis vinifera, Linn.
Vitis lanata, Roxb.
(ex parte.)
- Ampelocissus*.—Petals 5 (rarely 4), distinct.
Disk annular. Style short, conical ... *Vitis latifolia*, Roxb.
Vitis lanata, Roxb. (ex parte.)
Vitis divaricata, Wall.
- Ampelopsis*.—Petals 5 (rarely 4), distinct. Disk cupular. Style subulate ... *Vitis persica*, Boiss.
- Parthenocissus*.—Petals 5, distinct (rarely cohering at the apex). Disk inconspicuous, adnate to the base of the ovary. Style short, thick ... *Vitis semicordata*, Wall.
- Cissus*.—Petals 4. Disk cupular. Style subulate ... *Vitis trifolia*, Linn.
- Tetrastigma*.—Petals 4. Style 0. Stigma dilated flat, more or less four-lobed ... *Vitis capreolata*, D. Don.

Later botanists have divided the genus up in various ways. For practical purposes when dealing with a small number of species it is more convenient to keep it intact.

Leaves simple.

- | | |
|---|----------------------------|
| Leaves 2-3 inches long; plant with tendrils | 1. <i>V. parvifolia</i> . |
| Leaves 2-4 inches long; plant without tendrils ... | 2. <i>V. persica</i> . |
| Leaves 3-7 inches long. | |
| Petals distinct; leaves pubescent beneath. (See also <i>V. lanata</i> var. <i>glabra</i> .) ... | 3. <i>V. latifolia</i> . |
| Petals cohering; leaves with deciduous tomentum beneath ... | 4. <i>V. vinifera</i> . |
| Petals free or cohering; leaves with dense woolly tomentum beneath ... | 5. <i>V. lanata</i> . |
| Leaves palmately trifoliolate. Stems woody. | |
| Inflorescence terminal (rarely leaf-opposed), not tendril bearing ... | 6. <i>V. semicordata</i> . |
| Inflorescence leaf-opposed, bearing a tendril... | 7. <i>V. divaricata</i> . |
| Leaves pinnately trifoliolate. Stems herbaceous flattened... ... | 8. <i>V. trifolia</i> . |
| Leaves pedately 5-foliolate ... | 9. <i>V. capreolata</i> . |

1. *VITIS PARVIFOLIA*, Roxb. *Hort. Beng.* (1814) p. 18.—A wide-trailing slender climber, branches and tendrils glabrous, the latter bifid. Leaves 2-3 by 1·5-2 inches, ovate, base truncate or cordate, apex usually long-acuminate, sharply and deeply serrate, often 3-lobed, 5-nerved at the base, bearded in the axils of the nerves, otherwise glabrous, thin, membranous; petiole ·5-1 inch long. Inflorescence leaf-opposed, bifurcate, not exceeding 2 inches. Flowers minute, green, umbellate on tubercles or short peduncles along the branches of the inflorescence. Pedicels ·1-·2 inch long, very slender. Petals 5, cohering at the apex. Disk of 5 more or less confluent glands adnate to the base of the ovary. Style very short. Berry black, globose, the size of a pea. Seeds 2-4, rounded on the back with a spatulate tubercle, face wedge-shaped (if more than two seeds are developed) with shallow grooves on either side of the ridges. *Vitis flexuosa*, Thunb. var. *parvifolia*, Planch. DC. Monogr. Phan. V, p. 348.

Himalaya 4-7,000 feet from the Indus eastwards. Common in the east Punjab Himalaya, in Hazara less frequent than *V. persica*. See also *V. lanata*, Roxb. var. *glabra*. Flowers: April—May.

2. *VITIS PERSICA*, Boiss. *Fl. Orient.* I (1867) p. 955.—A wide-spreading slender climber, branches glabrous, pale-brown, ecirrhose. Leaves 2-4 inches long, broadly ovate, usually 3-lobed, base truncate or shallowly cordate, apex usually long-acuminate, sharply and coarsely toothed, 5-nerved at the base, the axils of the nerves tumid, membranous, pale beneath, quite glabrous; petiole ·7-2 inches long. Inflorescence leaf-opposed or terminal, 2 or more times dichotomously branched, 2-3 inches long, common peduncle about 1 inch long. Flowers green, not umbelled. Pedicels ·1-·2 inch long, rather stout. Petals 5, not cohering at the apex. Disk cupular, adnate to the base of the ovary. Style subulate. Berry black, the size of a pea, with two rings at the base, one being the persistent calyx and the other the slightly accrescent disk. Seed similar to that of *V. parvifolia*, Roxb., but with a spatulate spot (not raised) in place of the tubercle. *Ampelopsis vitifolia*, Planch. l. c., p. 454.

Hazara common, 5,000 feet. Chamba 8,000 feet. DISTRIB. Trans-Indus. The plant described is form *Griffithii* of Planchon.

3. *VITIS LATIFOLIA*, Roxb. *Hort. Beng.* (1814) p. 18.—A large deciduous climber, stems hollow, bark corky, tendrils long, bifid. Leaves 3-7 inches long, orbicular-cordate, 3-7-angled or -lobed sharply and irregularly toothed, glabrous above, more or less pubescent on the nerves beneath, basal nerves 5-7, the lowest pair branched on the lower side; petiole 2·5-4 inches long. Inflorescence a leaf-opposed, compact, thyrsoid

cyme. Peduncle long, usually bearing a bifid tendril close below the flowers. Flowers reddish-brown. Petals 5, not cohering at the apex. Ovary immersed in the disk. Style 0. Berry about .3 inch long, black, 2-, rarely 3-seeded, edible. Seeds elliptical, with a linear tubercle on the back and the margins transversely rugose, bluntly ridged on the face. *Ampelocissus latifolia*, Planch. l. c., p. 370.

Sub-Himalayan tract from the Sutlej eastwards. Attains a diameter of 2 inches or more. Large stems when cut into sections and held vertically exude a quantity of water which may be used for drinking. Flowers: May-July.

4. *VITIS VINIFERA*, Linn. *Sp. Pl.* (1753) p. 202.—A large deciduous climber, tendrils long, bifid. Leaves 3-6 inches long, orbicular-cordate, more or less deeply (3-) 5-lobed, margin irregularly and coarsely toothed, glabrous or nearly so above, clothed beneath with deciduous grey tomentum, thin, membranous; petiole 1.5-3 inches long. Inflorescence leaf-opposed of paniced cymes; peduncle sometimes bearing an unbranched tendril below the flowers. Flowers green. Petals 5, cohering at the apex. Disk reduced to 5 hypogynous glands adnate to the base of the ovary. Style very short, thick. Berry very variable in size, bluish black or greenish. Seeds 2-4; pear-shaped, with a discoidal tubercle on the back from which a low ridge runs over the top and down the ventral face. The *Grape Vine*. Vern. *angûr*.

Indigenous from the Barbary States to Trans-Caucasus. Cultivated in Hazara, Chamba and Kunawar and less frequently in the plains of the Punjab.

5. *VITIS LANATA*, Roxb. *Hort. Beng.* (1814) p. 18.—A large woody climber, branches petioles and inflorescence more or less woolly tomentose, tendrils long, bifid, one branch sometimes again forked. Leaves very variable, 3-6 inches long, sometimes longer, broadly ovate from a truncate or cordate base, undivided, angled or indistinctly lobed, shortly acuminate, dentate or sharply serrate, glabrous or nearly so above when mature, more or less clothed beneath with dense short woolly tomentum; petiole stout, 1.5-4 inches long. Inflorescence leaf-opposed, very variable, forked, subcorymbosely divided or thyriform, sometimes tendril bearing. Pedicels slender. Flowers green. Petals 5. Disk of 5 hypogynous confluent glands. Style 0. Berry .3 inch diameter, black, 1-3-seeded. Seeds obovoid, with a very short beak at the base and a spathulate tubercle on the back from which a low ridge runs over the top, ventral face wedge-shaped (if more than two seeds are produced) with a shallow linear groove on each side of the ridge. *V. lanata*, Roxb. Planch. l. c., p. 328, and *Ampelocissus rugosa*, Planch. l. c., p. 376.

VAR. *RUGOSA* (sp. Wall.).—Leaves clothed beneath with dense matted tomentum.

VAR. *GLABRA*.—Leaves becoming nearly glabrous beneath, stems more slender, inflorescence usually bifurcate as in *V. parvifolia*, Roxb., but rather longer (up to 3 inches).

Himalaya and Sub-Himalayan tract from the Indus eastwards, ascending to 8,000 feet, common. There has been much confusion over this variable plant. Planchon, Sir George King and other botanists have endeavored to separate *V. rugosa*, Wall., from *V. lanata*, Roxb. According to Planchon l. c., p. 329, *V. rugosa*, Wall., differs from *V. lanata*, Roxb., in having the petals spreading, whereas the latter has the petals united in a calyptra. This character is not always easy to observe in dried specimens particularly when the flowers are mostly still unopened and it is clearly valueless as I have a freshly dried specimen from Rupi in Bashahr State which shows in the same inflorescence flowers with the petals separating at the top and remaining attached to the torus with recurved tips and flowers in which the petals come away from the torus with the apices united. Sir George King in Journ. Asiatic Soc., Bengal, LXV, II, 2 (1896), p. 111, says of *V. rugosa*, Wall.—“This species has tendril bearing thyrses which do not bifurcate and the pubescence is felted and of a bright rufous color.” The point as to whether the inflorescence bears a tendril or not is certainly of no value as specimens frequently show inflorescences with and without tendrils on the same branch. The color of the tomentum is equally unreliable. I have two freshly dried specimens in which the inflorescence is not bifurcated and which have a white tomentum on the younger leaves tending to become reddish on the older leaves. All the specimens which have been kept some time in the herbarium have a red tomentum and I suspect that the tomentum when white at first becomes red in time. The color of the tomentum on living plants is a point to be settled in the field. Sir George King further remarks that the glabrous variety of *V. lanata*, Roxb., “so closely approaches *V. parvifolia*, Roxb., that I do not think the latter can be maintained as a species.” I think it would be better to consider var. *glabra* a form of *V. parvifolia*, but it would be going too far to unite *V. rugosa*, Wall., *V. lanata*, Roxb., and *V. parvifolia*, Roxb. The plant common in the Punjab is *V. lanata*, var. *rugosa*; var. *glabra* occurs from Nirth to Rampur in Bashahr. Flowers: April—June.

6. *VITIS SEMICORDATA*, Wall. in Roxb. *Fl. Ind. ed. Carey*, II (1824) p. 481.—A large deciduous climber, young shoots glabrous or slightly pubescent, tendrils branched, ending in adhesive disks, sometimes wanting. Leaves pinnately trifoliate; petiole up to 5 inches long, terminal leaflet up to 6 inches long, ovate or obovate, base cuneate or rounded, tip long-acuminate, margin coarsely cuspidate-serrate, lateral leaflets oblique, one side semicordate, the other semielliptic, midrib usually curved; dull green above, pale beneath, thin, membranous, petiolules 0·2 inch long. Inflorescence of terminal or sometimes leaf-opposed, 2- or 3-chotomous cymes, shorter than the leaves. Flowers yellowish-green, 4- or 5-merous. Petals ending in a conical hood which encloses the anther in bud, spreading and reflexed in flower. Disk inconspicuous. Style short, thick. Berry black, the size of a small pea, 1-4-seeded. Seeds obovoid, with one (or 2, if more than one seed develops), flattened faces, nearly smooth.

VAR. *TYPICA*.—Young branches, petioles and nerves on the under surface of the leaves hispid-pubescent. *Vitis himalayana*, Brandis, var. *semicordata*, Lawson in Fl. Brit. Ind. I, p. 655. *Parthenocissus semicordata*, Planch. l. c., p. 451.

VAR. *ROYLEI*, King.—All parts quite glabrous. *Vitis himalayana*, Brandis, For. Flora, p. 100 et Laws. in Fl. Brit. Ind. I., p. 656. *Parthenocissus himalayana*, Planch. l. c., p. 450. Collett, Fl. Siml., fig. 31.

Himalaya from the Indus eastwards, common, 6-10,000 feet. Climbs over the tallest trees with a stem up to 6 inches diameter. Both varieties are found growing together but they seem to be fairly well marked. The leaves turn a bright red color in autumn. Flowers: April—May.

7. *VITIS DIVARICATA*, Wall. Cat. (1828) No. 5994 h.—An extensive slender climber, stems hollow, tendrils long, bifid. Leaves palmately 3-, rarely 5-foliate, occasionally simple, lobed or imperfectly 3-foliately divided; petiole up to 5 inches long, terminal leaflets up to 8 inches long, elliptic or narrowly ovate, base cuneate sometimes broadly, tip acute or acuminate, margin cuspidate-serrate (not coarsely) or sub-entire, lateral leaflets oblique, one side semicordate, usually with one more or less distinct lobe, the other semielliptic, midrib straight or curved; thin, membranous, clothed on both sides but particularly beneath with white or pale-brown deciduous tomentum, when mature nearly glabrous; petiolules up to 1 inch long, those of the lateral leaflets slightly shorter. Inflorescence of leaf-opposed, 2- and 3-chotomously divided cymes; peduncle 2-6 inches long, bearing a branched tendril below the flowers. Flowers brown, red or purple. Petals 5, spreading, slightly hooded at the tips. Disk crenate, adnate to the base of the ovary. Style inconspicuous, fruit globose, the size of a small pea, 3-4-seeded. Seeds elliptic, .3 by .15 inch, flat, one side with an oval depression from which numerous grooves radiate, the other side with a low broad ridge widening from the base upwards. *Ampelocissus divaricata*, Planch. l. c., p. 378.

Himalaya from the Sutlej eastwards 4,000-6,000 feet, Simla and Bashahr, not common. Flowers: July—September.

8. *VITIS TRIFOLIA*, Linn. Sp. Pl. (1753) p. 203.—An extensive climber, stems herbaceous or woody at the base, compressed, densely pubescent when young, tendrils leaf-opposed, short, branched, ending in adhesive disks. Leaves pinnately 3-foliate, petiole up to 2 inches long; leaflets up to 2.5 inches long, ovate, elliptic or obovate, base cuneate or rounded, apex acute, margin more or less coarsely toothed, lateral leaflets slightly oblique, the broader side often faintly lobed; rather thick and succulent, more or less pubescent on both sides; petiolules of the terminal leaflets up to .5 inch long,

of the lateral leaflets 0·2 inch long. Inflorescence of axillary, terminal or leaf-opposed, 2- or 3-chotomous cymes; peduncle exceeding the petioles. Petals 4, distinct, hooded at the tips. Disk 4-lobed, adnate to the base of the ovary. Style subulate. Berry globose-obovoid, 3-4-seeded. Seeds triangular, round on the back, wedge shaped on the face. *Vitis carnosa*, Wall. Fl. Brit. Ind. I, p. 654. *Cissus carnosa*, Lamk. Planch. l. c., p. 570.

Plains and lower Himalaya from the Indus eastwards ascending to 4,000 feet, Salt Range, Changa Manga, Hissar. Common in dry hot valleys in the hills, usually in hedges. Flowers: July–September.

9. *VITIS CAPREOLATA*, D. Don. *Prodr. Fl. Nep.* (1825) p. 188.—A slender glabrous climber with wiry stems, tendrils leaf-opposed, long, slender, ending in adhesive disks. Leaves pedately 5-foliate; petiole up to 2 inches long, leaflets 1-4 inches long, the lateral smaller, lanceolate, narrowly ovate or obovate, apex rounded, acute or acuminate, margin crenate or sharply serrate, teeth ending in long cuspidate points, thin, membranous; petiolules up to 3 inch long. Inflorescence of axillary or terminal, umbelliform cymes; peduncle usually with conspicuous bracts, 1-5-rayed, rays usually bearing many umbellately clustered flowers. Petals 4, spreading, somewhat thickened at the tips. Disk adnate to the base of the ovary. Style 0. Stigma large, flat, four-lobed. Berry globose, the size of a small pea, black, 2-4-seeded. Seeds obovoid, thick, rounded and muricate on the back with a linear tubercle, flattened on the face. *Tetrastigma serrulatum*, Planch. l. c., p. 432.

Himalaya 3-7,000 feet from the Indus eastwards, not common. A very ornamental plant growing over rocks and tree trunks. Flowers: August–September.

The two following well-known climbers of gardens in Europe have been introduced and are grown in hill stations.

VITIS INCONSTANS, *Miq.*—A large climber clinging closely to walls. Leaves very variable in size and shape, cordate, ovate, undivided or 3-lobed, subcoriaceous, shining, glabrous when mature. Native of Japan and China (Usually known as *Ampelopsis* or *Vitis Veitchii*, Hort.)

VITIS HEDERACEA, *Ehrh.*—A large climber with a fine autumn coloration. Leaves 5-, rarely 3-foliate, dark green above, pale beneath. Native of North America. (Usually known as *Ampelopsis quinquefolia*, Michx.)

2. *LEEA*, Linn.

(In honor of James Lée, a nurseryman and botanist of the 18th century.)

Erect shrubs or trees, sometimes with herbaceous stems. Leaves alternate, 1-3-times pinnate or simple; petioles dilated at the base; stipules sheathing. Inflorescence corymbosely cymose, peduncle leaf-opposed. Flowers small, red, yellow or green. Calyx 5-toothed. Petals 5, revolute, connate at the base

and adhering to the staminal tube. Stamens united at the base into a 5-lobed tube; filaments inserted between the lobes of the tube, inflexed; anthers free and exserted from or connate and included within the tube. Ovary inserted on and sunk in the disk, 3-6-celled; style short; stigma thickened; ovules 1 in each cell. Berry 3-8-celled, usually succulent, depressed-globose, lobed. Seeds wedge-shaped. DISTRIB. Species about 45; tropical Asia, Africa and a few in Australia.

Leaflets acute, glabrous; flowers red ... 1. *L. alata*.
 Leaflets abruptly long-acuminate, scabrid; flowers green... 2. *L. aspera*.

1. *LEEALATA*, Edgew. in *Trans. Linn. Soc. XX* (1846) p. 36.—A large perennial herb dying back to a short woody base, stems hollow, sulcate. Leaves imparipinnate; petiole grooved, narrowly winged; stipules deciduous. Leaflets of the upper leaves 5-9, 6-12 by 1-2.5 inches, oblong, acute, base rounded or rhomboid, sessile or nearly so, glabrous or minutely puberulous on the nerves beneath, lateral nerves 8-12 pairs. Peduncles 3-8 inches long, stout, furrowed, pubescent; flowers crowded, red, .15 inch across; bracts and bracteoles minute. Lobes of the staminal-tube oblong, emarginate. Anthers connate. Berries .3-.4 inch diameter, reddish-purple.

Along the foot of the Himalaya from Sirmoor eastwards. Flowers: June—July. According to Brandis (*Ind. Trees*, p. 179) Duthie (*Fl. Upper Gang. Plain*, I, p. 175) and Haines (*Forest Fl. Chota Nag.*, p. 279) this plant is a shrub 2-5 feet high but according to Kanjilal (*For. Fl. ed. 2*, p. 112) and Brandis (*For. Fl.*, p. 102) and judging by the specimens it is herbaceous. Possibly it varies. I have seen no Punjab specimens.

2. *LEEALASPERSA*, Wall. in *Roxb. Fl. Ind. ed. Carey*, II (1824) p. 468.—A large perennial herb or undershrub, stems dying back and breaking off at the nodes leaving a persistent woody portion at the base, stems with large pith. Leaves towards the ends of the shoots simply pinnate or with the lower pinnae 3-foliate, lower leaves bipinnate; petiole not or scarcely winged. Leaflets of the upper leaves 5-7, 3-6 by 2-3 inches, ovate or elliptic-oblong, abruptly long-acuminate, base rounded or cordate, more or less scabrid above and on the nerves beneath, serrate, lateral nerves 12-18 pairs, curved and bifurcated near the margin; petiolules .2-.7 inch long, slender. Peduncles up to 2 inches long, trichotomously branched, often geminate, sometimes almost 0 when the cymes appear clustered, pubescent; flowers greenish, .1 inch across; bracts and bracteoles .1-.3 inch long. Lobes of the staminal tube oblong bifid. Anthers free. Berries .3-.4 inch diameter, green-slaty colored, finally black.

Sub-Himalayan tract and Himalaya ascending to 6,000 feet from the Indus eastwards. In forest undergrowth; fairly common in Kangra. Reaches 6-10 feet in height. Flowers: June—July. The fruit is edible.

XXXI. SAPINDACEÆ.

Trees or shrubs, rarely herbs: Leaves alternate or opposite, usually compound; stipules caducous or 0. Flowers usually polygamo-dioecious, sometimes irregular. Calyx usually 4-5-lobed or 4-5-sepalous, lobes or sepals imbricate, rarely valvate. Petals 4-5 or 0, free, equal or unequal, often bearded or bearing a scale at the base within. Disk usually distinct, annular or unilateral, sometimes of separate glands, rarely wanting in male flowers. Stamens 5-10, usually 8, inserted inside, on, or outside the disk; filaments usually free, often pubescent; anthers 2-celled, basifixed or versatile. Ovary entire, lobed or partite nearly to the base, sometimes excentric, 1-4-celled; ovules 1-2, rarely more in each cell, axile, ascending; style simple or divided, usually terminal. Fruit capsular or indehiscent, sometimes winged. Seeds generally exalbuminous, sometimes arillate, usually with a large hilum. **DISTRIB.** A large family mainly tropical.

The *Staphyleaceæ*, *Aceraceæ* and *Hippocastanaceæ* are often treated as separate families and excluded from the Sapindaceæ proper.

Leaves opposite.

Leaves trifoliolate	...	...	1. <i>Staphylea</i> .
Leaves simple, often palmately lobed	...	...	2. <i>Acer</i> .
Leaves digitate	...	...	3. <i>Æsculus</i> .

Leaves alternate.

Leaves paripinnate.			
Leaflets, 2-4 pairs	...	...	4. <i>Schleichera</i> .
Leaflets, 5-10 pairs	...	...	5. <i>Sapindus</i> .
Leaves, simple	...	...	6. <i>Dodonæa</i> .

1. STAPHYLEA, Linn.

(From the Greek *staphule*, a bunch of grapes; referring to the inflorescence. **DISTRIB.** About 10 species in North Temperate Regions and 1 in Peru.)

STAPHYLEA EMODI, Wall. Cat. (1828) No. 4275.—A large deciduous shrub, bark handsomely marked with pale whitish reticulations, twigs glabrous. Leaves opposite, 4-14 inches long, trifoliolate; stipules linear or oblanceolate, .5-.7 inch long, deciduous. Leaflets 2-6 by .8-3 inches, elliptic, acuminate, thin, membranous, sharply serrate, glabrous above, pale beneath and more or less pubescent when young, the lateral subsessile; stipules small, narrow-linear. Flowers .4 inch long, regular, bi-sexual, pentamerous, white, in terminal, usually drooping panicles 2-4 inches long; bracts .2 inch long, linear; pedicels .3-.6 inch long, glabrous. Calyx-tube very short, lobes oblanceolate-oblong, white, petaloid, imbricate. Petals .4 inch long, free, imbricate, slightly exceeding and narrower than the sepals. Stamens as long as the petals, inserted on the edge of

the disk, filaments hairy in the lower half; anthers versatile, broad, introrse, shortly apiculate. Disk lining the calyx-tube, obscurely 5-lobed. Ovary 2-3-lobed and -celled; styles as long as the stamens, free below, connate from the middle upwards; stigma small. Fruit an inflated bladder-like capsule 2-2.5 inches long, 2-3-celled and -lobed, dehiscing at the apex along the ventral suture; seeds few, .3-.4 inch long, obovoid-globose, slightly compressed, greyish-brown, polished, with a large basal scar. The *Snake-stick*. Vern. *Chitra*, *nāgdaun*.

Himalaya 6-9,000 feet mainly in the inner ranges, from the Indus eastwards, also Trans-Indus. Flowers: April—May. A shrub of forest undergrowth and moist shady ravines. The long straight shoots with their ornamental bark are much sought after for walking sticks as they are supposed to have the property of keeping off snakes.

2. ACER, Tourn. (*The Maples*).

(The classical name of the Maple.)

Trees or shrubs, buds scaly, the outer scales short, the inner developing when the buds open, oblong, membranous. Leaves opposite, simple, entire or lobed, or compound; stipules 0. Flowers regular, polygamous, usually male and bi-sexual on different trees. Calyx usually 5-, sometimes 4-12-partite. Petals isomerous with the sepals, sometimes wanting. Disk extra- or intra-staminal, annular often lobed, sometimes reduced to separate glands, rarely wanting. Stamens 4-10, usually 8, filaments free. Ovary of two carpels, 2-celled, 2-lobed; styles free or connate; ovules 2 in each cell. Fruit of two connate nuts ultimately splitting apart, the back of each produced into a large membranous reticulate wing, the lower edge of which is thickened. DISTRIB. Species about 100; temperate and mountainous regions of the Northern Hemisphere.

The wood of the Maples is generally shining, soft, close and even-grained, with distinct annual rings and no heart wood. It is used for making cups, plates, spoons, &c. The leaves are much lopped for fodder. The species are all semishade-bearers and have smooth or nearly smooth bark. Vern. *trekhan*, *tarkan*, *mandar* (most species).

Leaves undivided, entire	...	1.	<i>A. oblongum</i> .
Leaves 3- (5-) lobed, bluntly toothed	...	2.	<i>A. pentapomicum</i> .
Leaves usually 5-lobed, margins serrate.			
Leaves pale beneath	...	3.	<i>A. cæsium</i> ,
Leaves green beneath.			
Seratures distant, acumen short	...	4.	<i>A. villosum</i> .
Seratures close, acumen long	...	5.	<i>A. acuminatum</i> .
Leaves 5-7-lobed, margins entire	...	6.	<i>A. pictum</i> .

1. ACER OBLONGUM, Wall. ex DC. Prodr. I (1824) p. 593.—
A medium-sized or small evergreen tree, young shoots glabrous,

Leaves 2·5-6 by 1·7-2·5 inches, elliptic-oblong or ovate-lanceolate, acuminate, entire, glaucous beneath, base usually rounded, 3-nerved, quite glabrous, firm; petioles 1·7-2 inches long, longer on vigorous shoots. Flowers 1·3 inch across, greenish-white, pentamerous, in terminal corymbose pubescent panicles 3 inches long. Sepals 1 inch long, linear, acute, slightly hairy within. Petals narrow-lanceolate, slightly exceeding the sepals. Disk annular, lobed. Stamens 8-9, glabrous, inserted on or inside the disk. Ovary woolly; styles free almost to the base. Fruit glabrous; wings 1 inch long, diverging, contracted below, back nearly straight; nuts angular, clothed with white hairs within.

Lower Himalaya and Sub-Himalayan tract from the Indus eastwards, ascending to 6,000 feet, not common. Flowers: February—April. An ornamental tree often grown in gardens in the plains. It likes moist places, ravines, &c.

2. *ACER PENTAPOMICUM*, *J. L. Stewart, ex Brandis, For. Fl.* (1874) p. 111.—A small or medium-sized deciduous tree, young shoots glabrous. Leaves 1·5-4 by 2·5-6 inches, broader than long, 3-lobed or by a small additional pair 5-lobed, entire or bluntly toothed, paler or glaucous beneath, base cordate or rounded, 3-(5-) nerved, bearded in the axils of the nerves beneath when mature otherwise glabrous, rather firm; petioles 1·5-4 inches long, slender. Flowers 1·3 inch across, greenish-white, pentamerous, appearing with the young leaves in corymbose glabrous panicles 1·5-2 inches long, the bisexual flowers terminating dwarf shoots which bear two leaves below the panicle. Sepals 1·15 inch long, obovate. Petals a little shorter and narrower than the sepals. Disk annular 5-lobed, thin. Stamens inserted in depressions in the margin of the disk, 5 in bi-sexual flowers, as long as the sepals. Ovary glabrous; styles connate to the top. Fruit glabrous, wings 1 inch long, diverging, contracted below, back nearly straight.

Himalaya 2,500-7,500 feet in the inner dry valleys. Common in Kagan and Kunawar and more or less gregarious in association with other plants characteristic of the inner dry valleys such as *Quercus Ilex* and *Fraxinus xanthoxyloides*. Also along the Jhelum in Rawalpindi District from 1,800-3,500 feet. Flowers: March—April.

3. *ACER CÆSIUM*, *Wall. ex Brand. For. Fl.* (1874) p. 111, t. 21.—A large deciduous tree, young shoots glabrous. Inner bud scales 1·5-2 by 1·3-1·5 inch, reddish, silky. Leaves 3-6 inches long, broader than long, 5-lobed, cordate, lobes acuminate, serrate, usually pale and glaucous, sometimes green beneath, red when young, bearded in the axils of the nerves otherwise glabrous, basal nerves 5; petiole 3-5 inches long. Flowers 1·2 inch across, pentamerous, pale greenish-yellow, appearing

with the young leaves, in terminal corymbose puberulous panicles 2 inches long, on short side shoots. Sepals .15 inch long, obovate. Petals shorter than the sepals. Disk annular. Stamens in male flowers 8, inserted inside the disk; filaments glabrous. Ovary pubescent; styles connate half-way up. Fruit glabrate; wings 1.5-2 inches long, divergent, erect or sometimes overlapping, backs slightly curved; nuts dark-brown gibbous.

Himalaya 4-12,000 feet, usually between 6,000 and 9,000 feet. Trans-Indus eastwards; common. Flowers: March—May. Usually in open grassy places but also in moist patches of broad-leaved forest. Reaches a height of 70-80 feet and a girth of 12-13 feet.

4. *ACER VILLOSUM*, Wall. *Pl. As. Rar.* II (1831) p. 4.—A large deciduous tree, young shoots more or less clothed with long loose brownish hairs. Leaves 4-8 inches long, longer than broad when sub-3-lobed, broader than long when prominently 5-lobed, usually 5-lobed with the basal pair obscure, margin distantly toothed, lobes acuminate, dark-green above, paler green beneath, ciliate and often tomentose on the nerves beneath when young, base cordate, 5-nerved; petioles 2-6 inches long, rather stout. Flowers 5-merous, in simple or branched racemes, appearing before the leaves from lateral buds which do not produce leaves, peduncle and pedicels hairy. Sepals .15 inch long, oblong, ciliate. Petals linear oblong, ciliate, equalling the sepals. Stamens 5-8; filaments glabrous, inserted in depressions in the disk. Ovary very hairy; styles long, free. Fruit usually rusty-villous; wings 1.5-2 inches long, divergent or erect with the margins overlapping, backs usually curved; nuts rather large, brown, Brandis, Ind. Trees, fig. 82.

Himalaya 7-9,000 feet, much less common than *A. casium*. Flowers: February—March. According to the Fl. Brit. India this tree occurs from Kashmir to Kumaon. I have not seen it in the Punjab except from Bashahr. Usually easily distinguished from *A. casium* by the leaves being green, not pale, beneath. In addition the flowers and fruits occur on leafless shoots, whereas in *A. casium* they are on leafy shoots, the nuts also are much paler brown.

5. *ACER ACUMINATUM*, Wall. *apud D. Don, Prodr. Fl. Nep.* (1825) p. 294.—A small to medium-sized deciduous tree, young shoots glabrous. Inner bud-scales .6 by .25 inch, hairy within. Leaves 2-5 by 1.8-3.5 inches, 5-lobed with the two outer lobes smaller or sometimes wanting, lobes caudate-acuminate, sharply and closely serrate, bearded in the axils of the nerves beneath, otherwise glabrous, base rounded or subcordate, 5-nerved; petiole 2-4 inches long slender, reddish, puberulous. Flowers .2 inch across, greenish, in short, glabrous, corymbose racemes, which appear with the young leaves, the male on leafless, the bi-sexual on leafy-shoots, pedicels .5-2 inches long,

very slender. Sepals .15 inch long, oblong or ovate-oblong. Petals a little shorter than the sepals, oblanceolate, clawed. Stamens 4-6, inserted more or less outside the disk. Disk of separate irregular lobes in the male, annular in bi-sexual flowers. Ovary glabrous; style long, divided about half-way down. Fruit glabrous; wings 1 inch long, erect or divergent, backs straight or curved, bright-red when young; nuts rugose, brown. *A. caudatum*, Wall. Fl. Brit. Ind., I, 695 *ex parte*. Collett, Fl. Siml., fig. 32.

Himalaya 7,000-11,000 feet from the Ravi eastwards. Flowers: March—April. An elegant plant, fairly common. Included with East Himalayan species which differ considerably in the inflorescence in the Fl. Brit. Ind.

6. *ACER PICTUM*, *Thunb. Fl. Jap.* (1784) p. 162.—A large to medium-sized deciduous tree, young twigs glabrous. Inner bud-scales about 1 inch long, adpressed hairy. Leaves 2.5 by 2.5-7 inches, 5-7-lobed, lobes acuminate, margins entire, base usually cordate, bearded in the axils of the nerves otherwise glabrous, 5-7-nerved; petiole 1-6 inches long, slender. Flowers .3 inch across, greenish-yellow, pentamerous, in terminal, glabrous, trichotomous panicles, 2-4 inches long, on short leafy shoots, appearing with the young leaves. Sepals .15 inch long, oblong. Petals spatulate, equalling the sepals. Stamens 8, shorter than the calyx. Disk fleshy, deeply lobed, the stamens inserted on the disk in depressions between the lobes. Ovary glabrous; styles 2, free. Fruit glabrous; wings 1.1-3 inches long, divaricate, backs curved outwards, pink when young; nuts thin, compressed. *A. culturatum*. Wall. Brandis Ind. Trees, fig. 83.

Himalaya 5-10,000 feet. Trans-Indus eastwards to China and Japan. The commonest of the Himalayan Maples. Flowers: April—May.

ACER NEGUNDO, *Linn.*—A small tree of the Southern United States is cultivated in gardens and does well in the plains. It is easily distinguished from all the indigenous species by its pinnate leaves.

ACER SACCHARUM, *Marsh.*—A large tree. Leaves 3-5-lobed, lobes slightly toothed. Flowers apetalous, sepals united nearly to the top.

The *Sugar-Maple* of North America, has been tried in Kulu. Holes are drilled into the wood of the tree to collect the sap from which sugar is extracted.

3. *ÆSCULUS*, *Linn.* (*The Horsechestnuts*).

(The Latin name of an oak having edible acorns. *DISTRIB.* Species about 16 in North America, Asia and Europe, mostly temperate.)

ÆSCULUS INDICA, *Colebr. in Wall. Cat.* (1828) No. 1188.—A large deciduous tree, bark peeling off upwards in narrow strips, young shoots minutely pubescent or tomentose. Leaves opposite, digitate, exstipulate; petiole 4-6 inches long. Leaflets 5-9, 6-10 by 2.3-5 inches, the outer smaller, oblong-lanceolate or oblong-oblanceolate, acuminate, sharply serrate, glabrous,

narrowed at the base; petiolules .2-1 inch long. Flowers 1 inch long, irregular, in numerous, small, pubescent cymes arranged in terminal, erect, narrow-pyramidal panicles 12-15 inches long. Calyx .2-.3 inch long, tubular, shortly 5-lobed, splitting when the flower expands, often so as to appear 2-lipped, densely clothed with short, grey tomentum. Petals 4, clawed, tomentose outside, white and yellow, base often streaked with red, 2 petals narrower than the others. Disk unilateral, anterior, lobed. Stamens 7, inserted within the disk at the base of the ovary, filaments exceeding the petals. Ovary tomentose, narrow-oblong, 3-celled; ovules 2 in each cell; style simple, as long as the stamens. Fruit a capsule, 1-2 inches long, ovoid, not echinate, containing 1-3 seeds. Seeds 1 inch or more in diameter, dark-brown, shining. *Himalayan Horse-chestnut*. Vern. *Bankhor* (Haz.), *ban-akhor* (Rp.), *kanor* (Ku. Bash.), *gu* (Kun.)

Himalaya 4-10,000 feet. Flowers: April—May. Trans-Indus to Nepal. Reaches 100 feet in height and 25 feet in girth. The bark in large trees is very characteristic, the strips in which it peels off remaining attached at the top but slope outwards from the stem, the upper covering the lower loosely like shingles. The tree is met with in moist places being sometimes almost gregarious over a small area. The wood is pinkish or reddish soft and close-grained. It is used for cups, plates, &c. The leaves are much lopped for fodder.

4 SCHLEICHERA, Willd

(In honor of Schleicher, a Swiss botanist. DISTRIB. Species 2; Tropical Asia and the Philippines.)

SCHLEICHERA TRIJUGA, Willd. *Sp. Pl.* IV (1805) p. 1096.—A large deciduous tree, leafless only for a short time, bark smooth grey. Leaves alternate, imparipinnate; rachis 3-5 inches long; stipules 0. Leaflets 2-4 pairs, opposite, those of the lowest pair 2-3.5 by 1-2.5 inches, those of the terminal pair 4-9 by 1.5-4 inches, elliptic, entire, glabrous, apex usually rounded; petiolules almost 0, jointed to the rachis. Flowers yellowish-green, polygamo-dioecious, fascicled, in interrupted spike-like racemes, which are 3-5 inches long, simple or branched, axillary or below the leaves, or crowded on short shoots. Calyx .05 inch long, 4-6-lobed, lobes blunt. Petals 0. Disk annular, margin crenulate, larger in male flowers. Stamens 5-8, inserted inside the disk, in male flowers .15 inch long, in bi-sexual flowers scarcely exceeding the calyx, filaments more or less pubescent. Ovary 3-4-celled, narrowed into a very short, thick style; stigma 3-4-lobed; ovules 1 in each cell. Fruit .6-.8 inch long, ovoid, beaked, dry, indehiscent, 1-2-seeded. Seeds smooth, brown, enclosed in a succulent aril which is edible and has a pleasant acid taste, cotyledons oily. Vern. *Kussam*.

Sub-Himalayan tract from the Sutlej eastwards. Kalesar. Flowers: March-April, with the young leaves which are red. Wood very hard, light reddish

brown, durable. The arils are eaten and the seeds yield an oil. The tree is the best one for lac rearing. It is scarce in the Punjab. Grown in gardens in Lahore where it does well and is ornamental and shady.

5. *SAPINDUS*, Tourn.

(From Latin *sapo*, soap and *indicus*, Indian; the fruits of several species are used in place of soap. *DISTRIB.* Species about 40; tropical and sub-tropical.)

SAPINDUS MUKOROSI; *Gærtn. De Fruct.* I (1788) p. 342, t. 70.—A fairly large deciduous tree, bark smooth grey. Leaves alternate, 12-20 inches long, paripinnate; stipules 0. Leaflets 5-10 pairs, opposite or alternate, 3·5-6 by 1-2 inches, lanceolate, acuminate, entire, glabrous, often slightly falcate or oblique; petiolules 1-2 inch long. Flowers 2 inch across, greenish-white, subsessile, very numerous, mostly bi-sexual, in large, terminal, pubescent, pyramidal panicles. Sepals 5, 1 inch long, unequal. Petals 5, each with a woolly scale on each side at the top of the claw. Disk glabrous, annular, flat, with 5 elevated radiating lines. Stamens 8-10, inserted inside the disk, filaments woolly. Ovary 3-celled, glabrous, 3-lobed; style subulate; stigma small, 3-lobed. Fruit of 1-3 distinct indehiscent carpels, usually solitary, 7-1 inch diameter, globose, 1-seeded; pericarp fleshy, containing saponin; seed globose, black, large. *S. detergens*, Roxb. The *Soap-nut*. Vern. *ritha*, *dodan*, *thali*.

Indigenous to China. Cultivated in the Sub-Himalayan tract and lower hills up to 4,000 feet from the Ravi eastwards and less frequently from the Ravi to the Indus and in the plains. The soapnut is a common tree, in Kangra being much planted by natives and occasionally found self-sown. It is worthy of attention as a forest minor product as the fruits are readily saleable, the saponin in the pericarp making a lather with water and being used as a substitute for soap. For certain articles such as flannel it is preferable to soap. The tree requires a deep soil and does best with a rainfall of 70 inches or more. It does not grow very well in the plains and requires a moist cool situation. Reaches a height of 50-60 feet and girth of 6 feet or more, and makes a good roadside tree in suitable places. Flowers: May-June, fruits: October-January.

The *Soap-nut* of Southern India, *Sapindus laurifolius*, Vahl, is used for the same purpose. It should be tried in the plains of the Punjab as it grows well in Jaipur State, Rajputana, and would probably grow better than *S. Mukorosi*, provided the frost is not too much for it which can only be ascertained by trial.

6. *DONONÆA*, Linn.

(In honor of R. Dodons, a Dutch herbalist of the 16th century. *DISTRIB.* Species 65; mostly Australian.)

DODONÆA VISCOSA, Linn. *Mantiss.* II (1771) p. 149.—An evergreen shrub sometimes becoming a small tree, branches erect, twiggy, angular, young parts more or less viscid with a yellow resinous exudation. Leaves alternate, 1·5-3 by 2-1 inch, simple, oblanceolate, entire, apex emarginate, subacute or apiculate, base cuneately attenuate, bright-green, shining

and more or less viscid with yellow resin, thinly coriaceous, glabrous, subsessile; stipules 0. Flowers .2 inch across, greenish-yellow, regular, diœcious, in terminal panicles about 1 inch long. Sepals 4-5, about .1 inch long, oblong. Petals 0. Disk obsolete in male, small in female flowers. Stamens usually 8, as long as the sepals; anthers longer than the filaments. Ovary globose, scurfy, 3-4-celled, ovules 2 in each cell, style exceeding the sepals, cylindric, 3-4-fid. Fruit a membranous, septicidal capsule, 2-4-valved, each valve broadly winged on the back, .5 inch long, .7 inch across the wings. Seeds .15 inch long, dark-brown or black, dull. *Switch sorrel*. Vern. *Sanatta, mchndru* (Ka.).

Himalaya ascending to 4,500 feet, Salt Range, Sub-Himalayan tract not extending far into the plains. By far the commonest and most conspicuous plant in the zone which it occupies, frequently gregarious, often to the exclusion of other plants. Although usually only 12-15 feet high at most, it is of considerable forest importance as it yields an excellent firewood which though small is much appreciated for native cooking as it does not require to be split. Forests in which *Sanatta* is the prevalent species are usually worked nominally under the coppice with standards system although *Sanatta* does not coppice. The regeneration by seed is however usually profuse and a few stems left soon sow up an area felled or burnt. *Sanatta* is particularly sensitive to fire and the plant rarely escapes being killed by fires even of moderate intensity owing to its resinous twigs and leaves. As the plant is diœcious, when seed bearers are left they should be left in groups rather than singly. The growth in height is fairly fast during the first few years, but in diameter slow though this naturally varies enormously with the soil. Gamble gives 11-12 rings per inch radius. Wood very hard, dark-brown with black markings; weight 75-78 lbs. per cubic foot. The twigs are much used to support the earth in flat roofs. The plant is cultivated everywhere in gardens in the plains as a hedge plant for which it is excellent if constantly clipped, but if neglected the hedge very soon becomes thin below. *Sanatta* is useful for sowing up blanks in the Sub-Himalayan tract but has not been very successful in the Pabbi Hills where it is found mainly in sheltered places. *Sanatta* is very little damaged by browsing and is usually only eaten by goats in the absence of other food. Flowers: January—March. Fruit ripens in the hot weather.

NEPHELIUM LIT-CHI, Camb.—An evergreen shrub or small tree. Leaves alternate, exstipulate. Leaflets 2-8, opposite or alternate, 1.5-6 by .5-1.7 inches, oblong-lanceolate or ovate, acuminate, shining above, glaucous beneath. Flowers about .1 inch across, greenish, in terminal panicles. Calyx cup-shaped, 4-5-toothed. Petals 0. Stamens 6-10, inserted inside a fleshy, glabrous disk. Ovary 2-3-lobed, lobes 1-celled, 1-ovuled. Fruit of 1-3, ovoid, indehiscent carpels about 1.5 inches long by 1 inch diameter, red when ripe (brown as usually seen), pericarp dry, thin, brittle, sharply tuberculate, containing one large obovoid brown seed enclosed in a fleshy opalescent succulent sweet edible aril. Vern. *litchi*.

The *Litchi*, indigenous to China, cultivated but not often in gardens in the Punjab. Flowers: March. Fruit May—June.

XXXII. SABIACEÆ.

Trees or shrubs, erect or climbing. Leaves alternate, simple or imparipinnate, stipules 0. Flowers bi-sexual or polygamous.

Calyx (3-) 5-partite, lobes imbricate. Petals (4-) 5, free or slightly united at the base, imbricate, often opposite the sepals, the two inner usually much reduced. Disk small, annular. Stamens 5, opposite the petals, inserted at the base of or on the disk, free or coherent with the petals, all perfect or only the 2 inner, the three outer sterile; filaments clavate, flattened or subulate. Ovary superior, free, 2-3-celled, compressed or lobed; ovules 1-2 in each cell; styles 2-3, free, connate or 0; stigma minute. Fruit 1-2-celled, indehiscent. **DISTRIB.** A small family mainly tropical in South and East Asia and Tropical America.

Climbing shrubs; petals equal; stamens all fertile ... 1. *Sabia*.

Erect trees or shrubs; petals unequal; stamens 2 fertile, 3 sterile ... 2. *Meliosma*.

1. *SABIA*, Colebr.

(From *soobja*, the Bengali name of *S. lanceolata*. **DISTRIB.** Species 17; Indo-Malaya, China, Japan.)

SABIA CAMPANULATA, Wall. in Roxb. *Fl. Ind. ed. Carey*, II (1824) p. 311.—A small deciduous weakly twining shrub, twigs pale, glabrous. Leaves 1-4 by .5-1.5 inches, elliptic or oblong-lanceolate, entire, acuminate, thin, membranous pale and lustrous beneath; petiole .2-.6 inch long. Flowers .3 inch across, purplish, axillary, usually solitary, peduncles .5-1 inch long. Calyx, minute. Petals 4-5, .15-.2 inch long, opposite the calyx-lobes, broadly obovate, equal. Stamens 5, all fertile, filaments slightly dilated at the base. Disk annular, surrounding the base of the ovary, with glandular projections alternating with the stamens. Ovary of 2 (rarely 3) slightly coherent carpels, ovules 2 in each carpel; styles long, slightly cohering. Fruit turquoise-blue, 1-2-lobed and -seeded, .3-.4 inch diameter, slightly succulent on a subclavate peduncle 1-2 inches long. Seeds reniform, rugose.

Himalaya, 5-10,000 feet, in moist shady places on banks, &c. From Chamba and Kashmir eastwards. Not common but occurs in many places in Simla and Bashahr. Flowers: April—May.

2. *MELIOSMA*, Blume.

(From the Greek *meli*, honey, and *osme*, scent)

Trees or shrubs, erect. Leaves simple or pinnate. Flowers usually bi-sexual, supported by bracteoles similar to the sepals. Sepals generally 5, unequal, imbricate, usually ciliate, in a whorl continuous with the bracteoles. Petals 5, opposite the sepals; 3 large, nearly orbicular, concave, imbricate, 2 smaller, interior. Stamens 5; 2 fertile opposite and adnate to the smaller petals; 3 sterile opposite the larger petals; filaments expanding at the top into a cup which bears the 2 globose anther-cells. Disk cup-shaped or annular, with 2-5 simple or dentate teeth. Ovary

2-(3-) celled, contracted into a simple or partite style. Drupe small, oblique, endocarp usually 1-celled, 1-seeded. **DISTRIB.** Species about 46; Indo-Malaya, China, Japan, a few in Tropical America.

Leaves obovate, lateral nerves straight, teeth numerous close ... 1. *M. dilleniæfolia*.

Leaves oblanceolate, lateral nerves curved, teeth few, distant ... 2. *M. pungens*.

1. *MELIOSMA DILLENIÆFOLIA*, *Walp. Rep. I* (1842) p. 423.—A small deciduous tree, young shoots rusty-hairy. Leaves 4-12 by 2-5 inches, elliptic-obovate, shortly acuminate, cuspidate-serrate, membranous, scabrid above when young, rusty pubescent on the nerves and pale beneath, lateral nerves 15-20 pairs, straight, parallel; petiole .5-1 inch long, rusty-hairy. Flowers minute, .1 inch across, polygamous, white, very numerous, in large terminal panicles, 6-12 inches long, the lower branches often axillary; pedicels nearly as long as the flowers, in the axils of caducous bracts; bracteoles 0. Sepals 5, orbicular, ciliate, the two outer smaller. Petals 3 outer orbicular, 2 inner bifid, attached to but shorter than the fertile stamens. Stamens 2 fertile; 3 sterile attached to the outer petals near their base and reduced to two pocket-like structures. Disk cup-shaped, thin, surrounding the base of the ovary, margin crenulate and with 5 long narrow teeth (absent in male flowers). Ovary about twice as long as the disk, wanting in male flowers. Drupe .2 inch diameter, globose, black. Collett, *Fl. Siml.*, fig. 33.

Himalaya, 4-10,000 feet from the Beas eastwards. Not uncommon in Bashahr. Flowers: May--July.

2. *MELIOSMA PUNGENS*, *Walp. Rep. I* (1842) p. 423.—A small tree, young shoots rusty pubescent. Leaves 5-8 by 1-2 inches, oblanceolate, long-acuminate, coarsely and rather distantly cuspidate-serrate, rarely entire, firm, coriaceous, with fine adpressed hairs above when young, paler and glabrous or slightly hairy on the nerves beneath, lateral nerves about 8-10 pairs, arching; petioles .2-.7 inch long, rusty-pubescent and swollen at the base. Flower: minute, .15 inch across, polygamous, white, very numerous, in large terminal and axillary panicles, 4-10 inches long; pedicels hardly any; bracts 0, bracteoles 1-2, similar to but smaller than the sepals. Sepals 5, sub-orbicular, ciliate. Petals 5; 3 outer orbicular; 2 inner adnate to but shorter than the fertile stamens, with two spreading, triangular lobes at the apex. Stamens 2 fertile; 3 sterile deformed, adnate to the outer petals, filaments broad, anther represented by two empty pockets. Disk deeply cup-shaped, thin, surrounding the base of the ovary, margin with 5 linear

teeth, sometimes incomplete and unilateral. Ovary twice as long as the disk. Drupe .2 inch diameter, globose, black.

Himalaya 3-7,000 feet from the Indus eastwards. Not common but occurs in the Siran Valley, Hazara; Dharmasala, Kangra; Narkanda and Tak-lech, Bashahr. Flowers: May-June.

XXXIII. ANACARDIACEÆ.

Trees or shrubs, with resin-ducts in the twigs. Leaves alternate, simple or compound, exstipulate. Flowers small, regular, 1-2-sexual, usually in panicles. Calyx 1-6-partite, sometimes accrescent. Petals 3-5 or 0, free. Stamens usually as many as, or twice as many as the petals, inserted under (rarely on) the disk. Disk flat, cupular or annular, entire or lobed, rarely obsolete. Ovary usually superior, 1- or 2-6-(12)-celled; ovules solitary in each cell, pendulous or ascending, raphe directed towards the back of the carpel; styles free or united. Fruit various, dry or drupaceous with a resinous mesocarp, seeds exalbuminous. **DISTRIB.** Throughout the world, mainly tropical.

Leaves simple.

Fruit .2 inch long, dry ... 1. *Rhus*.

Fruit larger, usually succulent.

Stamen 1 perfect; fruit 2 inches long or more, succulent ... 2. *Mangifera*.

Stamens 5, fruit on a fleshy receptacle ... 3. *Semecarpus*.

Stamens 10, receptacle not fleshy ... 4. *Buchanania*.

Leaves trifoliate or pinnate.

Petals 0 ... 5. *Pistacia*.

Petal present.

Fruit not exceeding .3 inch long, dry ... 1. *Rhus*.

Fruit larger .5 inch long or more, succulent.

Leaflets without an intramarginal vein ... 6. *Lannea* (*Odina*).

Leaflets with an intramarginal vein ... 7. *Spondias*.

1. **RHUS**, Linn.

(From *rous*, the classical name of *R. Cotinus*, Linn.)

Trees or shrubs, often with acrid juice. Leaves alternate, simple, trifoliate or pinnate. Flowers small, polygamous, in axillary and terminal panicles. Calyx small, persistent, 4-6-cleft, lobes imbricate. Petals 4-6, equal, spreading, imbricate. Stamens 4-6 or 10, inserted beneath the edge of the disk. Disk fleshy, adnate to the base of the calyx, often 5-lobed, the lobes alternating with the stamens. Ovary 1-celled; ovule pendulous from a long basal funicle; styles 3, free or connate. Drupe small, dry, compressed, exocarp smooth or hairy, mesocarp

resinous, endocarp crustaceous or bony. DISTRIB. Species about 120; warm extratropical regions of both hemispheres.

- Leaves simple ... 1. *R. Cotinus*.
- Leaves trifoliate.
 - Terminal leaflets usually more than 2 inches long; plant unarmed ... 2. *R. parviflora*.
 - Terminal leaflets not more than 1.5 inches long; branchlets spinescent ... 3. *R. mysurensis*.
- Leaves pinnate.
 - Rachis winged; leaflets toothed ... 4. *R. semialata*.
 - Rachis not winged; leaflets mostly entire.
 - Panicles terminal ... 5. *R. punjabensis*.
 - Panicles axillary.
 - Leaflets sessile, tomentose beneath ... 6. *R. Wallichii*.
 - Leaflets stalked, glabrous or nearly so ... 7. *R. succedanea*.

1. *RHUS COTINUS*, Linn. *Sp. Pl.* (1753) p. 267.—A deciduous shrub, rarely a small tree, twigs reddish, grey-tomentose when young. Leaves simple, 2-4 inches long, elliptic, obovate or suborbicular, entire, glabrescent above usually more or less tomentose beneath; petioles 1.5-3 inches long. Flowers .15 inch across, yellowish, in terminal tomentose panicles; pedicels slender .1-.2 inch long; bracts linear up to .3 inch long. Fertile flowers few, pedicels of the sterile flowers elongating after flowering and becoming densely covered with long grey silky hairs, forming a lax panicle of slender feathery branches. Calyx more or less pubescent without, ciliate, lobes oblong, subacute, two-thirds as long as the petals. Petals .1 inch long, oblong, obtuse. Stamens as many as the petals, minute in fertile flowers. Disk slightly lobed between the stamens. Ovary globose, rudimentary and minute in sterile flowers; styles 3, free. Drupes .2 inch long, hairy, obliquely obovate. Collett, *Fl. Siml.*, fig. 34. Vern. *bhan, tung*.

Himalaya, Trans-Indus to the Sarda, 3-6,000 feet. Common and often more or less gregarious. Flowers: April—May. Heartwood dark yellow streaked and mottled, it could be used for small carving and inlaying. The leaves and bark are used for tanning. Known as the *Wig plant* in gardens in England.

2. *RHUS PARVIFLORA*, Roxb. *Fl. Ind.* II (1832) p. 100.—An unarmed shrub, young parts rusty-tomentose. Leaves trifoliate, petiole 1-2 inches long, rather stout, tomentose. Leaflets 1-5 by .6-3 inches, the terminal much the largest, obovate, the lower portion entire and cuneately attenuate, the upper coarsely and irregularly crenate, rather thick, hairy on the nerves especially beneath, the lateral relatively broader and more rounded at the base, sessile. Flowers less than .1 inch across, in large terminal panicles, the lower branches of

which are axillary, pedicels and bracts minute. Calyx much shorter than the petals, segments ovate, two narrower than the others. Petals oblong. Disk distinctly lobed. Styles free. Drupes .2 inch long, ovoid, brown, glabrous, shining.

Outer Himalaya 2-5,000 feet, from the Sutlej eastwards. Flowers : May—June. The fruit is eaten. Not common but has been collected in the Simla District.

3. *RHUS MYSURENSIS*, Heyne, ex Wight & Arn. Prodr. (1834) p. 172.—A spinescent shrub, young twigs pubescent. Leaves trifoliate; petiole .2-.7 inch long, pubescent. Leaflets .3-1.5 inches long, the terminal much the largest, obovate, cuneate and entire in the lower half, toothed or lobed in the upper half, glabrescent above, pubescent beneath, the lateral relatively broader, sessile. Flowers less than .1 inch across, in terminal and axillary panicles, pedicels and bracts minute. Disk obscurely lobed. Otherwise as for *R. parviflora*. Brandis, Ind. Trees, fig. 87.

Dry rocky hills in the South-East Punjab; Delhi. Flowers : July. A stiff much branched shrub; the bark is used for tanning.

4. *RHUS SEMIALATA*, Murr. in Comm. Gotting. VI (1784) p. 27, t. 3.—A shrub or small tree, deciduous, young twigs pubescent. Leaves pinnate, 10-18 inches long, rachis usually narrowly winged between the upper pairs of leaflets. Leaflets 5-13, the lateral opposite, sessile, 2-4 inches long, variable, from lanceolate or oblong to ovate or elliptic, acuminate, rather regularly and coarsely dentate or crenate, pubescent on the nerves above, tomentose beneath, the terminal leaflet on a marginate petiolule. Flowers .15 inch across, pale yellowish-green, very numerous, in large terminal tomentose panicles nearly as long as the leaves; bracts and pedicels minute. Calyx tomentose without, segments ovate. Petals thrice as long as the sepals, oblong, ciliate, with a thickened midrib which is bearded on the inner face near the base. Stamens exceeding the petals. Disk cupular, obscurely 10-lobed. Styles free or loosely cohering. Drupes .2 inch long, orbicular, flattened, reddish-brown, tomentose. Vern. *titar* (Haz. Rp.), *titri*.

Himalaya 3-7,000 feet from the Indus eastwards. Flowers : April—May; leaves turning red in autumn before falling. Locally common.

5. *RHUS PUNJABENSIS*, Stewart, ex Brandis, For. Fl. (1874) p. 120.—A small or medium-sized deciduous tree, young shoots pubescent. Leaves pinnate, 12-18 inches long; rachis terete, tomentose, not winged. Leaflets 9-15, the lateral opposite, sessile or nearly so, 2.5-5 inches long, ovate-oblong or lanceolate, acuminate, entire or with a few irregular teeth, slightly hairy on the nerves above, pubescent or sometimes

tomentose beneath. Flowers .1 inch across, pale yellowish-green; in pyramidal, terminal, pubescent panicles about half the length of the leaves; pedicels .05 inch long, bracts minute. Calyx pubescent without, lobes ovate. Petals twice as long as the sepals, elliptic-oblong, minutely pubescent and ciliate. Stamens exceeding the petals, anthers purple. Disk annular, broad, notched opposite the stamens. Styles free. Drupes .2 inch diameter, compressed, crimson, tomentose.

Himalaya 4-8,000 feet from the Indus eastwards. Common in the inner ranges in moist ravines, &c. The juice is corrosive and raises blisters on the skin in consequence of which the tree is not cut or hacked wantonly. Occasionally especially on sterile shoots, there is a minute wing to the rachis but it is scarcely more than a raised line. Flowers: May—July.

6. *RHUS WALLICHII*, Hook. f. in *Fl. Brit. Ind.* II (1876) p. 11.—A small deciduous tree, young shoots clothed with brown silky tomentum. Leaves pinnate, 12-18 inches long; rachis stout, tomentose, not winged. Leaflets 7-11, the lateral opposite, sessile or nearly so, 3-9 inches long, elliptic or oblong, subcoriaceous, entire, acuminate, pubescent above when young, softly tomentose beneath. Flowers .1 inch across, yellowish, subsessile, in dense axillary panicles much shorter than the leaves; bracts minute, hairy. Calyx glabrous, lobes broadly ovate, obtuse. Petals thrice as long as the calyx, oblong-obovate, yellowish with dark veins. Disk broad, cupular, obscurely lobed. Drupes .3 inch diameter, globose, densely crowded, puberulous, exocarp dehiscent from the apex forming stellately spreading segments which are united by their bases and form a support to the stone, mesocarp waxy, endocarp thick, bony. Brandis, *Ind. Trees*, fig. 88. Vern. *Arkhoh* (Bash.).

Himalaya 5-8,000 feet, from the Sutlej eastwards. Flowers: May—June. Not uncommon in Bashahr but apt to be mistaken for the Walnut which however has aromatic leaves. The juice of the leaves is very corrosive and the resin ducts in the bark are filled with a milky secretion which on exposure turns into a black acrid varnish and raises blisters on the skin.

7. *RHUS SUCCEDANEA*, Linn. *Mant.* II (1771) p. 221.—A medium-sized deciduous tree, young shoots glabrous. Leaves pinnate, 12-24 inches long; rachis terete, glabrous. Leaflets 7-15, the lateral opposite or sub-opposite, 2.5-6 inches long, ovate-oblong or lanceolate, long-acuminate, entire, thin, membranous, glabrous or nearly so, usually oblique; petiolules of the lateral leaflets .2-.4 inch long, slender. Flowers .15 inch across, in slender, drooping, rather lax, axillary panicles, half as long as the leaves; pedicels .1-.2 inch long, often puberulous; bracts caducous. Calyx glabrous or nearly so, lobes ovate. Petals thrice as long as the calyx, oblong, obtuse, with numerous dark veins. Disk 5-lobed. Styles connate at the

base. Drupes nearly $\cdot 3$ inch diameter, compressed, glabrous, shining, light-brown, mesocarp fibrous and waxy.

Himalaya 5-8,000 feet from the Indus eastwards mainly on the inner ranges in moist ravines &c. The juice is corrosive and the wood is not used. The tree has a wide distribution and extends to Japan where wax for candles is extracted from the fruits and the trees are tapped for lacquer varnish. The form described is var. *himalaica* of the Fl. Brit. Ind. and Engler in DC. Monog. Phan., IV, p. 400. Flowers: May-June.

Rhus copallina, Linn.—A shrub or small tree. Leaves pinnate, about 12 inches long. Leaflets about 23, rather distant, oblong-lanceolate, oblique, one side subentire, the other rather coarsely crenate-serrate, rachis narrowly winged. Panicles large terminal.

Indigenous to the Southern United States and Cuba. Introduced by Cuban seed in Lahore about 1907. Produces abundant root-suckers and has a fine autumn coloration. Flowers: August-September.

2. *MANGIFERA*, Linn.

(From *mango* and *fero*, I bear. **DISTRIB.** Species about 30; Tropical Asia, chiefly Malaya.)

MANGIFERA INDICA, Linn. *Sp. Pl.* (1753) p. 200.—A large evergreen tree, glabrous except the inflorescence. Leaves 6-12 by 1.5-4 inches, crowded at the ends of the branches, oblong or oblong-lanceolate, coriaceous, shining, entire, the margin often undulate, base acute; petiole 1.2-5 inches long, swollen at the base. Flowers about $\cdot 15$ inch across, yellowish-green, male and bi-sexual, in terminal panicles longer than the leaves. Calyx 4-5-partite, lobes ovate, concave, imbricate, pubescent without, shorter than the petals. Petals 4-5, imbricate, oblong, subacute, reflexed, with 3 strong orange-colored ridges on the inner face. Disk fleshy, 5-lobed. Stamens 4-5, inserted on the disk, one only perfect and longer than the rest; anther purple; filament subulate. Ovary 1-celled, sessile, obliquely ovoid, glabrous; ovule usually pendulous from a basal funicle; style lateral. Drupe 2-6 inches long, fleshy, compressed, ovoid, oblique, stone compressed fibrous. The *Mango tree*. Vern. *ām*.

Indigenous to Burma, Sikkim, Khasia and Satpura Hills and the Western Ghats. Cultivated everywhere in the plains and Sub-Himalayan tract up to 4,000 feet in Kangra where it is often self-sown. The best varieties of mango are propagated by inarching, the seedling trees grown by natives giving a very inferior small fruit usually full of fibre and with a strong flavor of turpentine. The inarched trees are however small and stunted and do not reach the size of seedling trees. The varieties in cultivation are very numerous, many of the best being unfortunately shy fruiters. Flowers March to April, fruits usually in July and August though some varieties are earlier and others later. The mango is sensitive to frost and requires shelter in winter in the Punjab for several years. Being grown for its fruit the tree is not felled for timber but the wood of dead trees is used for planking. It is a dirty white color, rather soft and rough-grained. The seeds do not retain their vitality long and frequently germinate as soon as the fruit is ripe.

3. SEMECARPUS, Linn. f.

(From the Greek *semeion*, a mark and *karpus*, a fruit ; referring to the use of the juice of the fruit for marking linen. DISTRIB. Species about 38 ; Tropical Asia and Australia.)

SEMECARPUS ANACARDIUM, Linn. f. *Suppl.* (1781) p. 182.— A moderate-sized deciduous tree, bark dark-brown, juice acrid, young parts tomentose. Leaves 7-24 by 4-12 inches, crowded at the ends of the branches, obovate-oblong, rounded at the apex, sometimes shortly auricled at the base, entire, coriaceous, glabrous above when mature, ashy-grey and more or less pubescent beneath, lateral nerves 15-25 pairs, prominent ; petiole .5-1.5 inches long, stout. Flowers .2-.3 inch across, greenish-yellow, polygamous or diœcious, subsessile, in fascicles arranged in large pubescent terminal panicles, the female panicles shorter than the male ; bracts lanceolate, pilose. Calyx-segments 5, .05 inch long, deciduous, pilose outside. Petals 5, .2 inch long, ovate. Stamens 5, inserted at the base of the disk, imperfect in female flowers. Disk broad, annular. Ovary 1-celled, subglobose, densely pilose, rudimentary and hairy in male flowers ; styles 3 ; ovule solitary, pendulous from the apex of the cell. Drupes 1 inch long, obliquely ovoid or oblong, smooth and shining, black when ripe, seated on a fleshy receptacle about .7 inch long, orange when ripe, edible. Brandis, Ind. Trees, fig. 91. *Marking-nut Tree*. Vern. *Bhilan*, *bhilawa*.

Sub-Himalayan tract from the Peas eastwards, not common. Flowers : May—June. The wood is soft and light ; it is not used. The receptacles of the ripe fruits are eaten raw, dried or roasted. The pericarp of the drupe contains a corrosive juice which is used for marking-ink. The wood contains an acrid juice which irritates the skin.

4. BUCHANANIA, Roxb.

(In honor of Francis Hamilton, M. D., formerly Buchanan of Leny in Scotland ; at one time Superintendent of the Botanic Gardens, Calcutta. DISTRIB. Species 25 ; Tropical Asia, Australia and the Pacific Islands.)

BUCHANANIA LATIFOLIA, Roxb. *Hort. Beng.* (1814) p. 32.— A small to medium-sized tree, almost evergreen, bark dark-grey or black, rough with small quadrangular plates divided by deep narrow cracks ; young shoots clothed with silky hairs. Leaves 6-10 by 2-3.5 inches, oblong or elliptic-oblong, entire, obtuse at both ends, coriaceous, hard, glabrescent above, more or less villous beneath, lateral nerves 15-20 pairs ; petiole .2-.7 inch long, stout, hairy. Flowers about .2 inch across, greenish-white, bisexual, sessile, in terminal and axillary rusty-hairy panicles shorter than the leaves ; bracts small, caducous. Calyx small, persistent, lobes 5, imbricate, broadly ovate, ciliate. Petals 5, .1 inch long, ovate-oblong. Disk fleshy, 5-lobed. Stamens 10, inserted at the base of the disk, nearly

as long as the petals, filaments flattened; anthers about as long as the filaments. Ovaries 1 perfect, conical, villous, the other 4 reduced to cylindrical filaments. Drupes .3-.5 inch long, ovoid-oblong, black when ripe; stone hard, bony, 2-valved; seed oily. *B. Lanzas*, Spreng. Cooke, Fl. Bomb., I, p. 275. Vern. *Charoli*.

Sub-Himalayan tract from the Sutlej eastwards; Kalesar. This tree is of little importance in the Punjab, but it is common on clayey soils in the United Provinces. The stems are straight and used for poles, etc., but are not durable. The bark can be used for tanning, the ripe fruits are edible as well as the kernels of the stones. The tree yields a gum of no particular value and an oil can be extracted from the seeds. Flowers: February—March.

5. *PISTACIA*, Linn.

(The classical name of *P. vera*, the Pistacio Nut. DISTRIB. Species about 7; Mediterranean Regions to China, 1 in Mexico.)

PISTACIA INTEGERRIMA, Stewart, ex Brandis, For. Fl. (1874) p. 122, t. xxii.—A medium-sized deciduous tree, with short bole and large spreading branches, bark dark-grey, rough. Leaves 6-9 inches long, pari- or impari-pinnate, rachis not winged. Leaflets 4-6 pairs, sub-opposite, 2.5-5 inches long, lanceolate, long-acuminate, entire, somewhat oblique, glabrous, minutely petiolulate. Flowers .1 inch across, reddish, diœcious, in lateral puberulous panicles, appearing with or just before the young leaves. Petals 0. Male flowers in compact panicles 2-6 inches long. Pedicels bearing 1 lanceolate woolly bract as long as the stamens, two shorter linear bracteoles with woolly tips and 1-2 minute calyx-segments. Stamens 5-7; filaments very short; anthers large. Disk small. Female flowers in laxer panicles 6-10 inches long. Pedicels bearing 1 bract, 2 ovate bracteoles and 4 linear deciduous calyx-segments. Stamens and disk 0. Ovary sessile, 1-celled; style short, 3-fid almost to the base; stigmas recurved; ovule pendulous from a basal funicle. Drupes .25 inch diameter, broader than long, glabrous. *Pistacia Khinjuk*, Stocks, Duthie, Fl. Upper Gang. Pl. 1, p. 187. *P. Khinjuk*, Stocks var. *Stocksii*, Engl. in DC. Monogr. Phan., IV, 291. Vern. *Kangar*, *kakar*, *kakrian*.

Himalaya 1,500-8,000 feet, extending to the inner ranges, Kagan valley, Kunawar, Trans-Indus, Salt Range. Flowers: March—May. Cultivated in the plains. The young foliage has a beautiful red tinge. The wood is hard and durable, the heartwood yellowish-brown mottled with yellow and dark veins. It is handsome and ornamental and is used for furniture, &c. Unfortunately large trees are almost invariably hollow. The tree is common but specimens suitable for timber are few and far between, consequently it is of little importance. Large crooked galls often 6-7 inches long form on the leaves and are used in native medicine and sold in bazars under the name *Kakrasingi*. The tree under cultivation reaches 40 feet in height and 12-15 feet in girth.

6. *LANNEA*, A. Rich. (*Odina*, Roxb.).

(From the vernacular name of *L. acida* in Senegambia. **DISTRIB.** Species 13; Tropical Africa and Asia.)

LANNEA WOODIER [*Odina* Woodier, *Roxb. Hort. Beng.* (1814) p. 29.]—A small or medium-sized deciduous tree, bark grey smooth except in large trees, branchlets thick, soft. Leaves 12-18 inches long, crowded towards the ends of the branches, imparipinnate. Leaflets 7-11, the lateral opposite, 3-6 by 2-3·5 inches, ovate or ovate-oblong, long-acuminate, entire, rather membranous, glabrous when mature, shining, base often oblique, lateral nerves 6-10 pairs, petiolules of the lateral leaflets 0·1 inch long. Flowers ·2 inch across, greenish, 1-sexual, 4-5-merous, appearing when the tree is leafless, crowded in cymose fascicles arranged in the male in compound racemes, in the female in simple racemes which are crowded towards the tips of the branches, the male and female usually on different branches, often on different trees; bracts ovate, acute, pubescent outside, ciliate. Calyx persistent, lobes 4, rounded, ciliate, as long as the tube. Petals 4, 2-3 times as long as the calyx, ovate-oblong, spreading. Disk annular, crenate. Stamens 8-10, inserted beneath and outside the disk, equalling the petals, small and sterile in female flowers. Ovary sessile, oblong, 1-celled, rudimentary and 4-lobed in male flowers; styles 3-4, short, stout; ovule solitary, pendulous from the apex of the cell. Drupes ·5 inch long, oblong, red when ripe, stone hard. Vern. *Kamlai* (Rp.), *kembal* (Ka).

Sub-Himalayan tract and Lower Himalaya from the Indus eastwards ascending to 4,000 feet; common. Salt Range, Sivaliks and occasionally in the adjacent plains. Flowers; March-April. A common tree but usually quite small and of no particular value. Incisions in the bark produce a flow of gum. It is easily propagated by cuttings but the seeds require to be sown as soon as ripe as they soon lose vitality. The young foliage is pinkish and the leaves turn yellow before being shed. The alteration of the generic name from *Odina* to *Lannea* is in accordance with the decision of the International Botanical Congress at Vienna in 1905.

7. *SPONDIAS*, Linn.

(A name used by Theophrastus for the plum. **DISTRIB.** Species 8; Tropics of the Old and New World.)

SPONDIAS MANGIFERA, *Willd. Sp. Pl.* II (1799) p. 751.—A deciduous tree, bark smooth grey, branchlets thick. Leaves 12-18 inches long, imparipinnate. Leaflets 7-11, the lateral opposite, 3-7 by 1·5-3 inches, elliptic or elliptic-oblong, acuminate, entire, soft, membranous, glabrous, lateral nerves 10-20 pairs, joined by a prominent vein running close to the margin; petiolules ·2 inch long. Flowers ·2 inch across, greenish-white, 1-2-sexual, sessile, clustered on the stout ramifications of a sparingly branched, glabrous, terminal panicle 10-15 inches

long. Calyx small, deciduous, lobes minute, triangular. Petals 5, .1 inch long, ovate-oblong, spreading. Stamens 10, about half as long as the petals, inserted beneath the disk. Disk broad, 10-crenate. Ovary sessile, 4-5-celled; ovules 1 in each cell, pendulous; styles 4-5, conniving above. Fruit drupaceous, 1.5-2 inches long, ovoid or oblong, fleshy, smooth, yellow when ripe, stone fibrous, woody, rough with irregular furrows and cavities, 1-5-celled, the cells opening by channels through the top of the stone. Seeds usually 1, more rarely 2-3 in each stone. The *Hog plum*. Vern. *Ambára*.

Salt Range and Sub-Himalayan tract from the Caenub eastwards. Flowers: March—May. Not as common as *Lannea Woodier* for which it is apt to be mistaken but which is easily distinguished by the absence of the intra-marginal vein to the leaflets. The Hog plum grows very readily from cuttings and is sometimes planted in hedges. It is also grown in gardens in the plains. The leaves turn yellow before being shed. The wood is soft and not used. The ripe fruits can be eaten, but they are very astringent and taste strongly of turpentine. Young fruits are pickled and made into curries. The tree yields a gum. All parts have a characteristic aromatic smell.

SCHINUS MOLLE, Linn.—A large shrub or small evergreen tree. Leaves 5-8 inches long, imparipinnate. Leaflets 15-27, sometimes more, about 1-1.5 by .2-.3 inch, linear, entire or serrate, rachis very narrowly winged. Flowers .15 inch across, in large lax terminal panicles. Calyx minute, lobes 4-5, orbicular. Petals 5, oblong, .1 inch long. Stamens 10, about as long as the petals in male, very small in female flowers. Disk 10-lobed. Ovary sessile, 1-celled; ovule 1, pendulous; style 3-fid almost to the base. Drupes .2 inch diameter, globose, red when ripe, exocarp papery, shining, mesocarp oily, endocarp hard. The *Pepper Tree*.

Indigenous to America from Mexico to Chili and in Southern Brazil. Commonly cultivated in gardens in Peshawar and Rawalpindi, very seldom seen in the Central and Eastern parts of the Punjab. Easily grown from seeds provided the young plants are not kept too damp in winter. The plant with its arching branches is very like *Prosopis glandulosa* at a little distance. Flowers: February—March.

SCHINUS TEREBINTHIFOLIUS, Raddi.—A large shrub. Leaves 2-5 inches long, rachis very narrowly winged. Leaflets 7-10, about 1-2.5 inches long, sometimes smaller, elliptic-oblong. Flowers in axillary panicles shorter than the leaves. Drupe .15 inch diameter, pale brown.

Indigenous to Brazil. Has long been cultivated in Saharanpur and more recently in Lahore. Flowers: August—November.

PLEIOGYNIUM SOLANDRI, Engl.—An evergreen tree. Leaves 7-9 inches long, imparipinnate or by abortion paripinnate, glabrous. Leaflets 7-11, 2-3 inches long, obliquely ovate or oblong, entire, very unequal at the base. Flowers .15 inch across, uni-sexual (monoecious?) in axillary lax panicles, those bearing male flowers about as long as the leaves, those bearing female flowers shorter and less branched. Calyx .05 inch long, 5-cleft; lobes thick, obtuse. Petals 5, 2-3 times as long as the calyx, obovate, imbricate. Stamens 10, as long as the petals, inserted in or under the crenatures of the disk. Ovary 5-10-12-celled; ovules solitary in each cell; styles short, spreading; stigmas spatulate; in male flowers pistillode rudimentary. Fruit a drupe, the size of a cherry; putamen woody, 5-12-celled. Seeds oblong, slightly curved outwards.

Indigenous to Queensland. Has been grown for many years in Lucknow and Saharanpur. Recently it has been introduced in Lahore and Kapurthala. It is a handsome tree which grows well in North-West India and deserves to be more often planted for ornament.

XXXIV. CORIARIACEÆ.

Glabrous shrubs, rarely annuals, twigs angular. Leaves opposite or ternate, simple, entire, exstipulate. Flowers small, green, bisexual or polygamous, axillary or in dense racemes. Sepals 5, ovate, with membranous margins, imbricate, persistent. Petals 5, shorter than the sepals, fleshy, sharply keeled within, after flowering becoming enlarged and thickened and embracing the fruit. Stamens 10, all free or 5 of them united to the keels of the petals, filaments short; anthers large, oblong, introrse. Disk 0. Carpels 5 or 10, free, 1-celled, whorled on a fleshy receptacle; styles free, slender, subulate, densely papillose; ovules solitary in each cell, pendulous from the top. Fruit of 5 or 10, oblong, compressed, dry nuts. DISTRIB. A very small family. The following is the only genus.

CORIARIA, Linn.

(From the Latin *coriarius*, pertaining to leather; the leaves of some species are used for tanning. DISTRIB. Species 8; Mediterranean Regions, Himalaya, Japan, Andes and New Zealand.

CORIARIA NEPALENSIS, Wall. *Pl. As. Rar.* III (1832) t. 289.—A large shrub, branches quadrangular arching, bark rough on old stems. Leaves 1-4 by .7-2.5 inches, opposite, nearly sessile, ovate or elliptic, abruptly short-acuminate, entire or very obscurely serrate, glabrous or sometimes papillose on the nerves beneath, 3-5-nerved. Flowers .2 inch across, greenish, in axillary solitary or clustered racemes 1-4 inches long; pedicels .1-.2 inch long; bracts about .1 inch long, ovate or oblong, concave, deciduous. Sepals .07 inch long. Petals .05 inch long. Stamens 10; filaments slender, free, as long as the sepals; anthers as long as the filaments, purplish. Carpels 5, laterally compressed, rounded on the backs; styles from the inner angle of the carpels, equalling the stamens, purplish. Fruit .2-.3 inch diameter, of 5 distinct 1-seeded, carpels enclosed within the accrescent, purple, succulent petals and separated from one another by the projecting keels of the petals. Collett, Fl. Siml. fig. 35. Vern. *Balél* (Haz.).

Himalaya 3-7,000 feet from the Indus eastwards. The vernacular name near Mussoorie is *masuri* and from it the hill station derives its name as the plant is very common in the neighborhood. Occasionally seen with stems 6-9 inches diameter but usually smaller, the wood is handsomely marked but it is not used. Flowers: March—May.

XXXV. MORINGACEÆ.

Large trees with soft wood. Leaves alternate, deciduous, 2-3-pinnate, pinnæ and pinnules imparipinnate, opposite, leaflets opposite, entire and as well as the pinnæ and pinnules

often with glands at the base, stipules 0. Flow rs large usually white, bisexual, irregular, in axillary panicles. Calyx cup-shaped, 5-cleft; segments unequal, petaloid, deciduous from above the base, imbricate. Petals 5, the upper smaller, the lateral ascending, the anterior larger. Disk lining the calyx-tube. Stamens inserted on the edge of the disk, declinate, 5 perfect opposite the petals, alternating with 5 (or 7) which are reduced to antherless filaments; anthers dorsifixed, 1-celled. Ovary stipitate, 1-celled; ovules numerous, biseriate on 3 parietal placentas; style slender, tubular; stigma perforated. Capsule elongated, beaked, 3-6-angled, 1-celled, loculicidally 3-valved. Seeds many, in pits in the valves, testa corky, winged or not. **DISTRIB.** A very small family. The following is the only genus.

MORINGA, Juss.

(From *muringo*, the Malabar name of *M. pterygosperma*. **DISTRIB.** Species 3; North Africa to Western Asia.)

MORINGA PTERYGOSPERMA, Gaertn. de Fruct. II (1791) p. 314.—A large deciduous tree with corky bark, roots pungent, young parts tomentose. Leaves 1-2.5 feet long, usually 3-pinnate, rachis slender, thickened and articulate at the base, pinnæ and pinnules opposite, deciduous, their rachises very slender, articulated and with a gland at the articulations. Leaflets .4-.8 inch long, opposite, the lateral elliptic, the terminal obovate and slightly larger, entire, membranous, pale beneath, nerves obscure; petiolules of the lateral leaflets .1 inch long or nearly so, of the terminal .2-.3 inch long. Flowers 1 inch across, white, strongly honey-scented, in large puberulous axillary panicles. Calyx-lobes .5 inch long, linear-lanceolate, reflexed, puberulous without. Petals .7-.9 inch long, linear-spathulate, white with yellow dots at the base. Filaments villous at the base. Ovary oblong, villous. Capsule 9-20 by .6-.8 inch, pendulous, 9-ribbed, slightly constricted between the seeds. Seeds about 1 inch long, 3-angled, the angles winged. **Vern. Sohanjna.** The *Horseradish tree*.

Sub-Himalayan tract, indigenous and cultivated from the Rawalpindi District eastwards, also cultivated in the plains and known to Europeans as the Horseradish Tree, as the young roots scraped furnish a good substitute for horseradish. The leaves, flowers and young fruits are eaten as vegetables and a gum is obtained by tapping the bark. An oil known as Ben oil is extracted from the seeds, it is valued by watchmakers and as a lubricant for delicate machinery. Perfumers hold the oil in high esteem for the property it possesses of absorbing and retaining fugitive odors. The tree is very easily propagated by cuttings, large shoots 8-10 feet long usually being used. The tree when lopped yields an excellent fodder for camels and it would be worth planting along watercourses in forests used for camel-browsing. The wood is spongy and valueless as it rots in a few months on exposure. Flowers: February—April.

MORINGA CONCANENSIS, *Nimmo*, is a similar tree to the above. It is planted in Jaipur State and Sind and may be met with in the S.-E. Punjab. It is recognised by the leaves being mostly bipinnate, leaflets with distinct nerves and flowers yellow streaked with red.

XXXVI. LEGUMINOSÆ.

Herbs, shrubs or trees. Leaves alternate (rarely opposite or whorled), usually stipulate, compound, 1-foliate or rarely simple, sometimes reduced to phyllodia (broadened petioles). Leaflets often stipellate, usually entire. Flowers usually zygomorphic and bi-sexual. Sepals 5, free, often unequal or connate into a frequently 2-lipped calyx. Petals 5 or rarely fewer by abortion, imbricate or valvate. Stamens normally 10, rarely fewer, sometimes indefinite, perigynous or sub-hypogynous; filaments free or connate into a closed or slit tube or connate at the base only; anthers 2-celled, dorsifixed or basifixed. Ovary usually 1 (rarely more), free, with 1 or more ovules on the ventral suture. Fruit a pod (legume), more rarely foliular or indehiscent or breaking up into one-seeded joints (very rarely drupaceous). **DISTRIB.** The second largest family of flowering plants containing about 7,000 species distributed throughout the globe.

Analysis of the Sub-families.

Petals unequal, free, imbricate; stamens 10 or fewer.

Calyx gamosepalous; filaments usually united ... *Papilionatæ.*

Calyx divided to the top of the disk or nearly so; filaments free ... *Casalpinoideæ.*

Petals equal, more or less connate, valvate; stamens 10 or indefinite ... *Mimosoideæ.*

Sub-family I—PAPILIONATÆ.

Herbs, shrubs or trees. Leaves alternate, simple, digitate or pinnate, stipulate. Flowers zygomorphic (rarely subregular), bi-sexual. Calyx gamosepalous, truncate or more or less distinctly 5-lobed or -toothed, the 2 upper lobes or teeth often connate and opposed to the 3 lower, rarely closed in bud and spathaceous. Corolla papilionaceous, petals 5, free or more or less connate amongst themselves or adhering to the staminal-tube, the posterior petal (standard) outside in bud, the 2 lateral (wings) intermediate, the two lower inside and usually cohering by the lower margins (keel). Stamens 10 or by abortion 9, monadelphous or diadelphous, the vexillary stamen free or all free.

Key to the Genera.

- | | | | |
|-----|-----------------------|-----|-----|
| 1 { | Erect trees or shrubs | ... | 2. |
| | Climbing shrubs | ... | 34. |

- | | | | | |
|----|---|--|-----|-----------------------|
| 2 | { | Leaves digitate | ... | 3. |
| | { | Leaves simple, trifoliate or pinnate | ... | 6. |
| 3 | { | Plant spiny | ... | 4. |
| | { | Plant unarmed | ... | 5. |
| 4 | { | Mature leaflets silky ; corolla red, included in the calyx | ... | 13. <i>Ebenus.</i> |
| | { | Mature leaflets glabrous ; corolla yellow, exserted | ... | 8. <i>Caragana.</i> |
| 5 | { | Leaflets gland-dotted beneath ; stamens diadelphous | ... | 26. <i>Flemingia.</i> |
| | { | Leaflets not gland-dotted beneath ; stamens free | ... | 1. <i>Piptanthus.</i> |
| 6 | { | Leaves simple or 1-foliate | ... | 7. |
| | { | Leaves trifoliate | ... | 11. |
| | { | Leaves pinnate | ... | 22. |
| 7 | { | Plant unarmed | ... | 8. |
| | { | Plant armed | ... | 14. <i>Alhagi.</i> |
| 8 | { | Leaves gland-dotted beneath ; flowers hidden by folded reniform bracts | ... | 26. <i>Flemingia.</i> |
| | { | Leaves not gland-dotted beneath | ... | 9. |
| 9 | { | Pod turgid ; flowers yellow | ... | 2. <i>Crotalaria.</i> |
| | { | Pod jointed ; flowers purple or white | ... | 10. |
| 10 | { | Calyx-teeth plumose ; pod folded up inside the calyx | ... | 16. <i>Uraria.</i> |
| | { | Calyx-teeth not plumose ; pod not folded | ... | 18. <i>Desmodium.</i> |
| 11 | { | Trees | ... | 12. |
| | { | Shrubs or undershrubs | ... | 15. |
| 12 | { | Flowering after the leaves ; pod indehiscent not jointed | ... | 27. <i>Dalbergia.</i> |
| | { | Flowering when more or less leafless | ... | 13. |
| 13 | { | Flowers less than .5 inch long ; pod jointed | ... | 17. <i>Ougeinia.</i> |
| | { | Flowers larger ; pod not jointed | ... | 14. |
| 14 | { | Twigs prickly ; flowers scarlet | ... | 21. <i>Erythrina.</i> |
| | { | Twigs not prickly ; flowers red tinged with orange | ... | 22. <i>Butea.</i> |
| 15 | { | Leaflets gland-dotted beneath | ... | 16. |
| | { | Leaflets not gland-dotted beneath | ... | 17. |

- 16 { A low undershrub ; branchlets tubercular ;
leaflets adpressed hairy beneath ... 3. *Psoralea*.
An erect shrub ; branchlets not tubercular ;
leaflets grey-tomentose beneath ... 25. *Rhynchosia*.
- 17 { Pod jointed if more than 1-seeded ... 18.
Pod not jointed ... 21.
- 18 { Pod folded up within the plumose calyx-
teeth ... 16. *Uraria*.
Pod not folded, more or less straight ... 19.
- 19 { Leaflets less than 1 inch long ; pod echinate 12. *Iaverniera*.
Leaflets larger ... 20.
- 20 { Flowers from the old wood ... 17. *Ougeinia*.
Flowers from the young shoots ... 18. *Desmodium*.
- 21 { Hairs dorsifixed ; pod cylindric, septate bet-
ween the seeds ... 5. *Indigofera*.
Hairs basifixed ; pod flattened, 1-seeded ... 16. *Lespedeza*.
- 22 { Plant unarmed ... 25.
Plant armed ... 23.
- 23 { Leaf-rachises deciduous ; stipules spiny ... 7. *Robinia*.
Leaf-rachises indurated, spiny ... 24.
- 24 { Calyx very oblique ; pod not longitudinally
divided ... 8. *Caragana*.
Calyx not oblique ; pod more or less longi-
tudinally divided by an ingrowth from
the dorsal suture ... 9. *Astragalus*.
- 25 { Trees ... 26.
Shrubs or undershrubs ... 28. *
- 26 { Pod slender, dehiscent, many-seeded ; flowers
yellow ... 4. *Sesbania*.
Pod indehiscent, few-seeded ... 27.
- 27 { Pod thin, strap-shaped ... 27. *Dalbergia*.
Pod firm and woody ... 28. *Pongamia*.
- 28 { Flowers yellow ... 29.
Flowers white, pink, red or purple ... 31.
- 29 { Pod moniliform ; stamens free ... 29. *Sophora*.
Pod not moniliform ; stamens united ... 30.

- { Pod very long, slender, septate between the seeds ... 4. *Sesbania*.
 30 { Pod inflated, bladder-like ... 10. *Colutea*.
 { Pod turgid more or less longitudinally divided by an ingrowth from the dorsal suture ... 9. *Astragalus*.
 31 { Pod jointed; leaflets linear-oblong, 3 inches long or more ... 16. *Urvia*.
 { Pod not jointed; leaflets shorter or broader ... 32.
 32 { Leaves large, 1-2 feet long; pod woody ... 11. *Milletia*.
 { Leaves smaller; pod not woody ... 33.
 33 { Hairs dorsifixed; anthers apiculate ... 5. *Indigofera*.
 { Hairs basifixed; anthers blunt ... 6. *Tephrosia*.
 34 { Leaves trifoliate ... 35.
 { Leaves pinnate ... 38.
 35 { Leaflets gland-dotted beneath ... 36.
 { Leaflets not gland-dotted beneath ... 37.
 36 { Pod turgid; 2-seeded, continuous within ... 25. *Rhynchosia*.
 { Pod flattened, 4- or more-seeded, septate ... 24. *Atylosia*.
 37 { Pod flat; stamens monadelphous, anthers uniform ... 23. *Pueraria*.
 { Pod turgid; stamens diadelphous, anthers dimorphous ... 20. *Mucuna*.
 38 { Leaves 2-4 inches long, leaflets 10-20 pairs ... 19. *Abrus*.
 { Leaves 1-2 feet long, leaflets 7-9 ... 11. *Milletia*.

TRIBE I—PODALYRIÆ.—Leaves digitate; stamens free; pod indehiscent ... 1. *Piptanthus*.

TRIBE II—GENISTEÆ.—Leaves simple or digitately trifoliate; stamens monadelphous; pod dehiscent, not jointed ... 2. *Crotalaria*.

TRIBE III—GALEGEÆ.—Leaves usually imparipinnate, leaflets entire; stamens usually diadelphous; pod usually dehiscent, not jointed.

Pod 1-seeded, indehiscent ... 3. *Psoralea*.

Pod distinctly septate between the seeds.

Pod very long, slender; flowers yellow ... 4. *Sesbania*.

Pod cylindric firm; flowers usually purple ... 5. *Indigofera*.

Pod not or scarcely septate.

Pod many-seeded, soon dehiscent.

Flowers mostly in leaf-opposed racemes 6. *Tephrosia*.

Racemes mostly axillary.

Pod flattened; flowers white ... 7. *Robinia*.

Pod turgid, flowers yellow.

Calyx very oblique ... 8. *Caragana*.

Calyx not oblique ... 9. *Astragalus*.

Pod few-seeded, subdehiscent or late in dehiscent.

Pod bladder-like ... 10. *Colutea*.

Pod woody ... 11. *Millettia*.

TRIBE IV—HEDYSARÆÆ.—Leaves usually imparipinnate; stamens mon- or diadelphous; pod jointed if more than 1-seeded.

Leaflets exstipellate.

Stamens monadelphous.

Flowers in a lax raceme ... 12. *Taverniera*.

Flowers in dense heads ... 13. *Ebenus*.

Stamens diadelphous.

Armed, leaves simple ... 14. *Alhagi*.

Unarmed, leaves trifoliate ... 15. *Lespedeza*.

Leaflets stipellate (stamens 9 and 1)

Pod folded so that the joints are brought face to face ... 16. *Uraria*.

Pod straight.

Racemes in fascicles from the old wood 17. *Ougeinia*.

Racemes simple or panicled from the year's shoots ... 18. *Desmodium*.

TRIBE V—VICIÆÆ.—Leaves pinnate, rachis ending in a tendril or bristle; stamens diadelphous or the tenth abortive; pod dehiscent, not jointed ... 19. *Abrus*.

TRIBE VI—PHASEOLEÆÆ.—Climbers, rarely erect plants, mostly with pinnately trifoliate leaves; stamens mon- or diadelphous; pod dehiscent not jointed.

Leaves not gland-dotted; nodes of the racemes tumid.

Petals very unequal in length.

Keel exceeding the wings and standard ... 20. *Mucuna*.

Standard exceeding the wings and keel ... 21. *Erythrina*.

Petals sub-equal in length.

A tree; pods 1-seeded ... 22. *Butea*.

A climber; pods many-seeded ... 23. *Pueraria*.

Leaves gland-dotted beneath ; nodes of the raceme not tumid.

Seeds 3 or more ; pod with depressed lines between the seeds ... 24. *Atylosia*.

Seeds 1-2 ; pod not depressed between the seeds.

Leaves pinnately trifoliate ... 25. *Rhynchosia*.

Leaves simple or digitate ... 26. *Flemingia*.

TRIBE VII.—DALBERGIEÆ—Leaves imparipinnate ; stamens mon- or diadelphous ; pod indehiscent, not jointed.

Leaflets alternate, pod thin ... 27. *Dalbergia*.

Leaflets opposite, pod woody ... 28. *Pongamia*.

TRIBE VIII.—SOPHOREÆ—Leaves imparipinnate ; stamens free ; pod moniliform ... 29. *Sophora*.

1. PIPTANTHUS, D. Don.

(From the Greek *piptein*, to fall, and *anthos*, a flower ; referring to the early falling of the flowers. DISTRIB. Species 2 ; Himalaya and Yunnan.)

PIPTANTHUS NEPALENSIS, D. Don, in *Sweet, Brit. Flower Gard.* (1828) t. 264.—An erect deciduous shrub 8-12 feet high ; young shoots silky, 1-year old glabrous, dark olive-brown, shining. Leaves digitately 3-foliate ; petiole .7-1.5 inches long, narrowly margined ; stipules .5-.8 inch long, connate, opposite the petiole, deciduous but leaving a small persistent annular basal portion. Leaflets 2-4 by .5-1.5 inches, sessile, lanceolate or elliptic-oblongate, entire, acute, glabrous above, pale beneath and adpressed silky when young, ultimately glabrous, midrib stout, prominent beneath. Flowers 1-1.25 inches long, yellow, in short racemes ; pedicels .5-.7 inch long, villous ; bracts .5 inch long, ovate, densely hairy. Calyx .5 inch long, campanulate, densely grey-tomentose outside, the two upper teeth broad, united to above the middle, the three lower lanceolate, as long as the tube. Petals clawed ; standard erect, blade orbicular, notched, margins reflexed ; wings nearly as long as the obtuse slightly incurved keel. Stamens free ; anthers uniform. Ovary on a stipe .2 inch long, hairy on the dorsal suture ; style filiform, incurved ; stigma minute, terminal. Pod 3-5 by .4-.7 inch, stalked, flat. Seeds 3-10.

Himalaya from the Sutlej eastwards 7-10,000 feet. Usually in moist forest undergrowth. Cultivated for its flowers in gardens in England. Flowers : April—June.

2. CROTALARIA, Linn.

(From the Greek *krotalon*, a rattle ; referring to the rattling of the seeds in the inflated pods.)

Herbs or shrubs. Leaves simple, 3-foliate or rarely 5-7-foliate. Flowers in terminal or leaf-opposed racemes, usually

yellow, often showy. Calyx-tube short; teeth linear or lanceolate, sub-equal or shortly connate into 2-lips. Corolla equalling or exceeding the calyx; standard orbicular, rarely ovate, claw short; wings shorter than the standard, obovate or oblong; keel equalling the wings, its petals united, much incurved and distinctly beaked. Stamens monadelphous, tube slit along the top; anthers alternately short and dorsifixed and long and basifixed. Ovary sessile, rarely stipitate, usually many-ovuled; style long, abruptly bent at the base, more or less bearded upwards. Pod usually sessile, turgid or inflated, continuous within, usually many-seeded. **DISTRIB.** Species about 250; tropical and sub-tropical regions of the globe.

The genus contains many more or less woody herbs some of which are perhaps shrubs at times. The following is the most woody and the commonest:—

CROTALARIA BURHIA, *Buch.-Ham. in Wall. Cat.* (1828) No. 5386.—A low shrub or undershrub with stiff sometimes spinescent erect and spreading often tangled branches, 1-2 feet high. Twigs often leafless or nearly so, striate and densely pubescent. Leaves few, deciduous, simple, 2-1 inch long, oblong, entire, subsessile, clothed on both sides with adpressed silky hairs, margin thickened, lateral veins obscure; stipules 0. Flowers about 6-12, in elongated terminal racemes; pedicels very short, 2-bracteolate. Calyx 3 inch long, densely hairy, teeth lanceolate. Corolla yellow, scarcely exceeding the calyx. Pod scarcely longer than the calyx, hairy, 3-4-seeded.

In sandy or rocky places. Salt Range, Phillaur, Kot Lakhpat, S.-E. Punjab. A common plant in arid well drained places not usually found on loamy soils liable to be water-logged in the rains. Flowers during the cold season.

3. **PSORALEA**, Linn.

(From the Greek *psoraleos*, scurfy; referring to the appearance of most species. **DISTRIB.** Species about 100; chiefly in North America and South Africa.)

PSORALEA Plicata, *Delile, Fl. d'Egypte* (1812) p. 252, t. 37, fig. 3.—A low much-branched undershrub 1-2 feet high; stems firm, woody, canescent and striate when young, dotted with scattered glandular tubercles, the denuded branchlets subspinescent. Leaves trifoliate; petiole 2-5 inch long, glandular; stipules about 1 inch long, oblong, acute, costate. Leaflets, the terminal 5-1 inch long, oblong; the lateral 2-5 inch long, obovate; all subcoriaceous, dull-green, irregularly sinuate, closely adpressed hairy on both sides, gland-dotted beneath; lateral leaflets subsessile; stalk of the terminal leaflet about 2 inch long. Flowers 2 inch long, solitary or in fascicles of 2 or 3 along a striate axillary rachis 2-4 inches long; pedicels

·05 inch long, hairy; bracts as long as the pedicels, ovate, acute. Calyx ·15 inch long, silvery-hairy outside, accrescent in fruit; teeth triangular, shorter than the tube, the lowest the longest. Petals ·2 inch long, yellow, all with distinct claws; keel obtuse, the tip slightly incurved. Upper stamen free or connate, the tube often closed at the commencement of flowering; anthers small, uniform or slightly dimorphous. Pod ·2 inch long, ellipsoid, densely hairy, completely enclosed in the accrescent calyx which becomes membranous and many-nerved.

The plains; Lahore, Hissar, etc. Common in arid places. Camels are very fond of this plant. Flowers: April.

4. *SESBANIA*, Scop.

(From *sesban*, the Arabic name of the following species. **DISTRIB.** Species about 40; tropical.)

SESBANIA *EGYPTIACA*, Poir. *Encyc.* VII (1806) p. 128.—A small soft-wooded tree of rapid growth and brief duration reaching 15 feet in height and 6 inches diameter, young shoots striate, green, canescent. Leaves 3-6 inches long, paripinnate; rachis shortly produced above the last pair of leaflets, not spinescent; stipules ·15 inch long, linear, acute, caducuous. Leaflets 9-14 pairs, opposite, ·7-1 by ·15-·25 inch, linear-oblong, entire, obtuse, often faintly apiculate, puberulous when young, minutely petiolulate. Flowers ·5-·6 inch long, yellow, in lax, slender, few-flowered, axillary racemes; buds straight; pedicels filiform, ·2-·4 inch long; bracts less than ·1 inch long, lanceolate, scarious, bracteoles setaceous, both fugacious. Calyx ·2 inch long, campanulate, 5-nerved; teeth deltoid, subequal, shorter than the tube. Standard orbicular, spotted with purple on the back, furnished at the base with two keel-like appendages which are free and falcate above, running down wing-like into the claw; wings falcate-oblong, with a minute auricle at the top of the claw; keel straight, obtuse, its petals with a small recurved auricle above the claw. Stamens diadelphous; anthers uniform. Ovary stipitate; style incurved, glabrous; stigma capitate. Pod 6-9 inches long by ·1-·15 inch, pendulous, twisted, flexible, slightly torulose, sharply beaked, sutures not much thickened, septate between the seeds. Seeds 20-30. *S. aegyptiaca*, Baker, Fl. Brit. Ind., II, p. 114 *ex parte*. Vern. *jānt*.

Cultivated in the plains and Sub-Himalayan tract, not wild and rarely self-sown. The genus as described in the Flora of British India is much confused,—*vide* Prain in Journ. As. Soc. Beng. lxxvi (1897), page 367. The form above described is var. *picta*, Prain, l.c., grown in hedges both by Europeans and natives owing to its remarkably rapid growth in good soil with plenty of moisture. Flowers mainly during the cold season. The other varieties described by Prain are var. *typica* with uniformly yellow flowers and var. *bicolor* with the standard dark maroon or purple outside and the keel tipped with red. These are also both met with in gardens. Var. *typica* is probably native in some parts of India and var. *picta* was probably introduced from America.

SESBANIA ACULEATA, *Pers. var. ELATIOR*, Prain, a large shrub-like annual, is apt to be mistaken for the above. It is wild in the Punjab and sprang up in large quantities in Kot Lakhpat plantation as soon as irrigation was started. It reaches a height of 10 feet but does not last over the winter.

SESBANIA GRANDIFLORA, *Pers.*—A soft-wooded tree 20-30 feet high. Leaves 6-12 inches long; leaflets 16-30 pairs, about 1 by .25 inch. Flowers 3-3.5 inches long, showy, white or red. Buds falcately recurved. Calyx shallowly 2-lipped, 1 inch long. Pod 12-20 inches long, firm, sutures much thickened.

Indigenous from Malaya to North Australia. Cultivated in the East Punjab, Delhi. Has been tried in Lahore but is killed by frost in winter and can only be grown as an annual.

5. INDIGOFERA, Linn.

(From the Latin *indicum*, a blue pigment believed to be indigo and *fero*, I bear; the genus yields the indigo of commerce.)

Herbs or shrubs, more or less clothed with adpressed hairs fixed by the centre (dorsifixed). Leaves simple or imparipinnate; stipules usually small, setaceous, shortly adnate to the petiole; leaflets entire, stipellate or not. Flowers pink, red or purple, usually in axillary racemes. Bracts caducous, minute or long, often enclosing the flower buds. Calyx small, teeth 5, subequal or the lowest the longest. Standard ovate or orbicular, sessile or clawed, often persistent for a long time; wings oblong, slightly adherent to the keel; keel straight, spurred on each side near the base. Stamens diadelphous (the upper free); anthers tipped with a minute point. Ovary sessile; ovules usually many; style glabrous, incurved; stig a small, capitate, often minutely hairy. Pod cylindric, turgid, septate between the seeds, often deflexed. **DISTRIB.** Species 250-300; throughout the warmer regions of both hemispheres, abundant in Central and South Africa. **Vern.** *Káthi*, *kainthi* (most species).

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|---|-----|-----------------------------|
| Leaflets 3-5, alternate ... | ... | 1. <i>I. paucifolia</i> . |
| Leaflets more than 5, opposite. | | |
| Flowers small, .3 inch long or less ... | ... | 2. <i>I. tinctoria</i> . |
| Flowers large (for the genus), exceeding .3 inch. | | |
| Bracts minute, shorter than the calyx ... | ... | 3. <i>I. Gerardiana</i> . |
| Bracts as long as or longer than the flower buds. | | |
| Bracts linear or lanceolate. | | |
| Densely pubescent or tomentose ... | ... | 4. <i>I. Dosua</i> . |
| Nearly glabrous ... | ... | 5. <i>I. atropurpurea</i> . |
| Bracts boat-shaped. | | |
| Flowers very dark red-purple ... | ... | 6. <i>I. hebeptala</i> . |
| Flowers bright pink ... | ... | 7. <i>I. pulchella</i> . |

1. *INDIGOFERA PAUCIFOLIA*, *Delile, Fl. d'Egypte* (1812) p. 251.—A shrub 3-6 feet high; branches stout, woody, silvery-canescant. Leaves imparipinnate; leaflets 3-5, alternate,

linear or elliptic-lanceolate or oblanceolate, more or less hairy above, densely clothed with fine white hairs beneath, base acute; petiolules of the lateral leaflets .05 inch long, stalk of the terminal .25 inch long; stipules lanceolate, acuminate, .1 inch long. Flowers small, brick-red, in long spicate 20-50-flowered racemes exceeding the leaves and attaining 4 inches. Calyx .1 inch long, silvery outside; teeth triangular, acute, equalling the tube. Corolla thrice as long as the calyx; standard densely hairy on the back. Pods slightly curved outwards, deflexed, torulose, pointed, hoary pubescent when young, 6-8-seeded, .5-.7 inch long. *I. oblongifolia*, Forsk.

The plains of the Punjab in the South-West; Delhi; Multan.

2. *INDIGOFERA TINCTORIA*, Linn. *Sp. Pl.* (1753) p. 751.—A shrub 4-6 feet high; branches more or less angular, slightly silvery with adpressed hairs. Leaves 2-3 inches long, drying a greyish-black; leaflets 7-13, opposite, ovate, oblong or oblanceolate, glabrous above, thinly adpressed-hairy beneath; petiolules of the lateral leaflets .05 to .1 inch long, stalk of the terminal up to .25 inch long; stipules minute, subulate. Flowers in pedunculate, many-flowered, erect, spike-like racemes shorter than the leaves. Calyx .05 inch long, silvery outside; teeth triangular, acute, equalling the tube. Standard greenish-yellow, pubescent on the back, wings pink. Pod straight or slightly curved, glabrous when mature, 8-12-seeded, 1-1.5 inches long. Vern. *Nil*.

The cultivated *indigo-plant*. Found here and there as an escape. According to Dr. Prain and Mr. E. Baker "Notes on Indigoferæ" in the *Journal of Botany*, *I. tinctoria*, Linn., may be considered as representing 3 distinct forms, one of which is found in a semi-wild state near Agra and Muttra as well as in Rajputana. Another form *I. sumatrana*, Gaertn., is the cultivated plant of the Punjab.

3. *INDIGOFERA GERARDIANA*, Wall. *Cat.* (1828) No. 5486.—A deciduous shrub up to 6-8 feet high and 2-3 inches diameter at the base. Twigs densely white-canescens. Leaves very variable in size, 1-4 inches long; leaflets very variable, 9-31, .1-.5 inch long, opposite, elliptic, obovate or oblanceolate, obtuse or retuse, mucronate, clothed on both sides with adpressed white hairs, pale beneath; petiolules .05 inch long; stipules setaceous; stipels small. Flowers about .5 inch long, pale red or purple, in erect pedunculate racemes 1-5 inches long. Pedicels very short; bracts minute. Calyx obliquely campanulate, hairy; teeth triangular or narrow-lanceolate, about as long as the tube. Corolla much longer than the calyx; standard and keel hairy towards the top. Pod 1-2 inches long, straight, cylindric, glabrous. *I. heterantha*, Wall. Collett, Fl. Siml., fig. 36.

Himalaya 5,000-12,000 feet. Flowers: May-July. One of the commonest shrubs in the hills and perhaps the most variable. In dry exposed situations the size of the plant and of all its parts is much reduced. It is common and gregarious on open grassy hillsides and is useful in affording shelter to tree seedlings in such places, as it never gets very dense. It is also found in dry forest undergrowth but avoids moist shady ravines.

4. *INDIGOFERA DOSUA*, *Buch-Ham. ex D. Don, Prodr. Fl. Nep.* (1825) p. 244.—A large shrub attaining 15 feet but in the Punjab apparently only an undershrub; branches slender, woody, from a thick woody rootstock, grey-tomentose. Leaves 2-3 inches long, leaflets 17-31, opposite, .3-.5 inch long, elliptic, very shortly stalked and with a long mucro, clothed on both sides with adpressed grey hairs, dull green above, pale beneath; stipules long, setaceous; stipels 0. Flowers bright-red, nearly .5 inch long, in peduncled racemes 1-3 inches long. Pedicels minute; bracts narrow-lanceolate, long-pointed, silky, much exceeding the flower-buds. Calyx less than .1 inch long; teeth deltoid-cuspidate, about as long as the tube, densely silky. Corolla much exceeding the calyx; standard densely hairy on the back. Pod about 1 inch long, pubescent, straight.

Himalaya from the Sutlej eastwards, 6-8,000 feet. Flowers: May-June.

5. *INDIGOFERA ATROPURPUREA*, *Buch-Ham. ex Roxb. Hort. Beng.* (1814) p. 57.—A shrub 12 feet high. Bracts lanceolate, acuminate, not enclosing the flower-buds. Otherwise as for *I. hebeptala*, Benth., which is perhaps not specifically distinct.

Himalaya ascending to 5,000 feet from (Hazara?) Kashmir eastwards. Apparently not nearly so frequent as *I. hebeptala*. I have only seen one specimen from the Punjab in Herb. Dehra and no West Himalaya specimens from more than 5,000 feet. When not in flower the two species are indistinguishable.

6. *INDIGOFERA HEBEPETALA*, *Benth. ex Baker, in Hook. f. Fl. Brit. Ind.* II (1876) p. 101.—A tall deciduous shrub, twigs pale-brown, sparsely hairy when young. Leaves 4-10 inches long; leaflets 7-17, opposite, 1-2.5 inches long, ovate or ovate-oblong; usually obtuse, mucronate, thinly hairy or glabrous, membranous, bright-green above, pale beneath; petiolules .1 inch long; stipules setaceous; stipels small. Flowers dark-purple, .5 inch long, in erect racemes 4-10 inches long. Pedicels very short, bracts boat-shaped with long cuspidate points, enclosing the flowers-buds. Calyx .1 inch long, obliquely campanulate, hairy; teeth short, deltoid or rounded. Corolla much exceeding the calyx, glabrous. Pod 1-2 inches long, glabrous.

Himalaya 6-10,000 feet from the Indus eastwards, common. Flowers: May-August. A plant of moist shady ravines.

7. *INDIGOFERA PULCHELLA*, *Roxb. Hort. Beng.* (1814) p. 57.—A deciduous shrub 4-6 feet high; twigs striate, more

or less hairy when young. Leaves 3-6 inches long, leaflets 11-21, opposite, .5-1 inch long, elliptic, rounded or retuse at the apex, mucronate, thinly hairy on both sides, pale-green above, more or less glaucous beneath; petiolules very short; stipules subulate, caducous; stipels minute or 0. Flowers in dense racemes 2-4 inches long, bright-pink fading to violet, .5 inch long or longer. Pedicels short; bracts boat-shaped, long-pointed, silky hairy, exceeding the flower-buds. Calyx .1 inch long, densely hairy; teeth short, deltoid. Corolla much exceeding the calyx, glabrous outside. Pod 1-1.7 inches long, straight, glabrous.

Himalaya ascending to 5,000 feet and extending out into the Sub-Himalayan tract, common, from the Indus eastwards. Also Trans-Indus. This is the common *Indigofera* of the *Pinus longifolia* zone occurring on banks and in grassy blanks and also extending downwards into the scrub forests. Flowers in the early hot weather when it is shedding or has shed its leaves. The leaves are thicker and more glaucous than in the other species. Frequently bears brown furry burrs on the twigs.

6. TEPHROSIA, Pers.

(From the Greek *tephra*, ashes; referring to the pubescence of most species.)

Herbs, undershrubs or shrubs. Leaves imparipinnate, rarely simple, stipulate, leaflets opposite, lateral veins parallel, making an acute angle with the midrib. Flowers in leaf-opposed racemes or solitary or paired in the leaf-axils. Calyx-teeth various. Petals clawed; standard suborbicular; wings obliquely obovate or oblong; keel incurved, not beaked. Stamens diadelphous when the flower is fully open; anthers obtuse, uniform. Ovary sessile, usually many-ovuled; style incurved, often flattened, glabrous or bearded; stigma terminal, often penicellate. Pod linear or oval, continuous within or obscurely septate between the seeds. **DISTRIB.** Species more than 120; warm regions of both hemispheres.

Pod glabrescent or finely downy, slightly recurved ... 1. *T. purpurea*.

Pod densely hairy, much recurved ... 2. *T. villosa*.

1. **TEPHROSIA PURPUREA**, Pers. *Syn. Pl.* II (1807) p. 329. — A herbaceous perennial, undershrub or shrub; branches glabrous or sparsely pilose. Leaves 2-4 inches long; stipules linear, subulate, erect or reflexed; leaflets 9-21, oblanceolate, .7-1.2 inches long, obtuse or retuse, mucronate, base cuneate, glabrous above, clothed with adpressed silky hairs beneath; petiolules .1 inch long or less. Flowers purple, in leaf-opposed racemes 1-6 inches long, the lower flowers fascicled. Pedicels .1-.2 inch long; bracts minute. Calyx .15 inch long, silky; teeth linear-subulate, as long as the tube. Corolla twice as long as the calyx; standard silky on the back. Style flattened, glab-

rescent; stigma penicellate. Pod 1-2 inches long, slightly curved, thinly hairy when young ultimately glabrescent.

Plains and hills ascending to 6,000 feet. Usually herbaceous, a shrubby form is often found in dry places, *e.g.*, on the Ridge at Delhi. A very variable plant apt to be mistaken for an *Indigofera* from which it differs in the flattened pod, absence of basifix hairs and strongly nerved leaflets. Flowers during the rains.

2. *TEPHROSIA VILLOSA*, *Pers. Syn. Pl. II* (1807) p. 329.—Similar to the woody forms of the above, but branches densely clothed with adpressed white hairs. Flowers subsessile, bracts linear-subulate equalling or exceeding the pedicels. Calyx teeth thrice as long as the tube. Pod curved upwards at the tip, densely clothed with grey or fulvous hairs.

A plant found on the ridge at Delhi belongs perhaps to this species. (It has pedicellate flowers and a grey tomentose pod, calyx teeth nearly twice as long as the tube.) Flowers during the rains.

7. *ROBINIA*, Linn.

(In honor of J. Robin, Herbalist to Henry IV of France and his son Vespasian who first cultivated the species mentioned below in Europe. *DISTRIB.* Species about 10; Southern United States and Central America.)

ROBINIA PSEUD-ACACIA, *Linn. Sp. Pl.* (1753) p. 722.—A medium-sized deciduous tree, bark with deep irregular longitudinal cracks. Twigs glabrescent, angular. Leaves 4-6 inches long; petioles swollen at the base; stipules usually transformed into stout straight or slightly curved spines up to .8 inch long. Leaflets 9-19, elliptic or oval, 1-2 inches long, opposite or sub-opposite, entire, glabrescent above, pale beneath and ultimately puberulous only on the nerves; petiolules .1 inch long; stipels .05 inch long, setaceous. Flowers white, in pendulous axillary racemes up to 8 inches long on the current year's wood. Pedicels up to 1.5 inches long; bracts and bracteoles small, caducous. Calyx .2 inch long, campanulate, puberulous; teeth shorter than the tube, the upper shorter than the lower. Corolla .6 inch long; standard orbicular, clawed, notched at the apex and marked in the middle with a greenish-yellow spot, reflexed in flower; wings equalling the standard and keel, free; keel with a blunt incurved tip. Stamens 10, the upper more or less united with the rest; anthers uniform. Ovary stipitate; style hairy and with a ring of hairs below the small terminal stigma. Pod up to 4 inches by .7 inch, flat, glabrous, continuous within. Seeds smooth.

Native of the United States, cultivated and more or less naturalized in Europe and Japan. The *Black Locust* of America, the *False Acacia* of England, in India it is usually called *Robinia*. It is grown occasionally in many parts of the Punjab from the plains to 10,000 feet in the hills particularly near Simla. As an ornamental plant it is worth growing for its flowers which in the plains are produced in March and April, but at low elevations it remains small and is apt to die off suddenly for no apparent reason.

As a forest tree much was expected of it and in 1890 and for many years following it was cultivated indiscriminately in the hope that it would be useful for reafforesting bare hills. In such places as Changa Manga, the Pabbi, the Salt Range and Kala-Chitta it has naturally been a failure though a few plants are still found here and there. The tree likes a deep loose soil and thrives on sand and poor mineral soils but it does not like heavy soils or shallow rocky ground and consequently it has not come up to expectation in the hills. For made soils, such as road embankments, landslips, &c., it is excellent provided the situation is not too hot and dry. In such places it will reach 6 feet from seed in the first year and as it produces abundant root-suckers it soon fixes the ground. In less favorable places it may make remarkable growth for a year or two but soon comes to a standstill and dies. Sowing should be done in spring, not during the rains and transplanting during the rains should also be avoided. Large plants 4-5 feet high can easily be transplanted and this has been the practice in Simla. As the tree is deep-rooted the roots are much injured when such plants are moved and this perhaps accounts for most of the Robinia in Simla becoming hollow. The tree is quite frost-hardy, but is apt to be broken by snow and it does not ripen its seeds well in places with a heavy monsoon rainfall. Its further cultivation should be restricted to really porous soils above 4-5,000 feet.

8. CARAGANA, Lamk.

(From the Mongolian name for *C. arborescens*.)

Trees or shrubs (or in subgenus *Chesneya* herbs), leaves paripinnate, often crowded, sometimes digitate; rachis ending in a bristle or spine usually persistent; stipules subulate or spinescent, rarely small and herbaceous. Flowers yellow, solitary or in long-stalked few-flowered umbels. Calyx campanulate, placed obliquely on its pedicel; teeth deltoid or lanceolate. Corolla much exserted; standard broad, clawed, edges reflexed; wings oblique, lanceolate, free, long-clawed; keel blunt, nearly straight. Stamens diadelphous, anthers uniform. Ovary sessile, many-ovuled; style straight or slightly incurved; stigma small, terminal. Pod turgid, continuous but sometimes pubescent within. DISTRIB. Species 20; Central Asia and China.

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| Leaflets crowded more or less digitate | ... | 1. <i>C. pygmaea</i> . |
| Leaves imparipinnate. | | |
| Flowers subsessile. | | |
| Stipules coriaceous, amplexicaul, persistent | ... | 2. <i>C. Gerardiana</i> . |
| Stipules scarious, free, deciduous | ... | 3. <i>C. sikiensis</i> . |
| Flowers peduncled. | | |
| Calyx-teeth lanceolate, cuspidate; pod woolly within | ... | 4. <i>C. brevispina</i> . |
| Calyx-teeth subulate; pod glabrous within | ... | 5. <i>C. decorticans</i> . |

1. *CARAGANA PYGMÆA*, DC. *Prodr.* II (1825) p. 268.—A small shrub, 2 feet high, young twigs furrowed, pubescent, internodes short. Leaf-rachis 3-4 inch long, persistent with the spinescent stipules as a 3-fid spine, suppressed on dwarf shoots; leaflets 4, digitate, very narrowly oblanceolate, about 3 inch long, pale-green, thickish, pubescent when young, glabrous when mature. Flowers solitary, pedicels shorter than the leaves,

jointed below the middle. Calyx .2 inch long, glabrous; teeth short, deltoid. Corolla thrice the calyx; wing-petals with a very short auricle. Pod linear, turgid, glabrous within and without, 1 inch long.

Himalaya from Kashmir eastwards 8-13,000 feet, Kunawar. Flowers June.

2. *CARAGANA GERARDIANA*, Royle, *Ill. Bot. Himal.* (1839) p. 198, t. 34, fig. 1.—A shrub, 3-4 feet high, twigs densely brown-hairy when young, nodes close. Leaf-rachis .5-1.5 inches long, persistent, spinescent; stipules connate behind the rachis, amplexicaul, not spinescent, thick, persistent, coriaceous; leaflets 8-10, oblanceolate, .2-.3 inch long, acute, densely silky. Flowers 1-2, subsessile. Calyx .4 inch long, densely hairy; teeth deltoid-cuspidate, half as long as the tube. Corolla twice the calyx. Wing-petals with a very short auricle. Pod .7-1 inch long, woolly within and persistently pubescent without.

Himalaya 8-12,000 feet. Kunawar, also Trans-Indus, Kurram and Waziristan. Apparently only found in the dry Inner Himalaya. Flowers: May.

3. *CARAGANA SUKIENSIS*, C. K. Schn., *Bull. Herb. Boiss. sér. 2, VII* (1907) p. 313.—A small shrub 2 feet high. Young twigs slightly grooved, internodes .3 inches long. Leaf-rachis .8-1.5 inches long, persistent, spinescent; stipules free, deltoid, scarious, not persistent; leaflets 10-12, narrowly elliptic-oblong, .2-.3 inch long, sub-acute, silky beneath. Flowers 1-2; pedicels hairy up to .2 inch long. Calyx .5-.6 inch long, slightly silky; teeth lanceolate, acuminate, half as long as the tube. Corolla less than twice the calyx; wing-petals with a long linear auricle nearly as long as the claw. Pod 1 inch long, pubescent without, woolly within.

Himalaya 8-9,000 feet. Chamba, Tehri-Garhwal. Should be looked for in Kunawar. This plant is easily distinguished from *C. Gerardiana* by the long auricle of the wing-petals, and by the stipules. Flowers: June.

4. *CARAGANA BREVISPIA*, Royle, *Ill. Bot. Himal.* (1839) p. 198.—A tall erect shrub 6-8 feet high, twigs pubescent when young, internodes not crowded, .5-2 inches long. Leaf-rachis usually spinescent and persistent, .7-2.5 inches long; stipules usually spinescent, occasionally the spines are weakly developed or wanting; leaflets 8-12 (-14) varying a good deal in size, .3-1 inch long, obovate, elliptic or elliptic-oblong, apex rounded or retuse, mucronate, glabrous above, pale and silky beneath. Flowers in few-flowered umbels; peduncle .5-2 inches long; pedicels .2 inch long. Calyx .3 inch long, pubescent; teeth narrowly triangular-cuspidate, about half as long as the tube. Corolla thrice the calyx; wing-petals with a long auricle nearly

equalling the claw. Pod 1·2-2 inches long, pubescent without, woolly within.

Himalaya 6-10,000 feet in moderately dry forest undergrowth; common in Kagan and Bashahr and more or less gregarious in deodar forests. Also Trans-Indus. Flowers: May—July.

5. *CARAGANA DECORTICANS*, Hemsl. in Hook. Icon. Pl. XVIII (1887) t. 1725.—A large shrub or small tree, in habit and appearance like *Laburnum*, twigs slender, furrowed, pubescent when young. Rachis persistent and weakly spinescent or more usually deciduous; stipules rigid, spinescent, persistent, up to 4 inch long; leaflets 6-10, elliptic and acute or obovate and retuse, 2·5 inch long, with a long mucro, sparsely adpressed silky on both sides. Flowers solitary, peduncles 7-1·5 inches long, slender, jointed near the top. Calyx campanulate, 2 inch long, sparsely pubescent; teeth subulate, much shorter than the tube. Corolla four times as long as the calyx, wing-petals with a long auricle half as long as the claw. Pod flattish, 1·5 inches long, glabrous within and without. *C. Aitchisoni*, Prain, Journ. Asiatic Soc. Bengal, LXVI, ii, 2 (1897) p. 372.

Hazara (fide Prain l.c. I have seen no specimens from the Punjab or Hazara.) Kurram, Chitral, 9-11,000 feet.

9. *ASTRAGALUS*, Linn.

(From the Greek name of a shrub supposed to belong to or be related to this genus.)

Herbs, undershrubs or shrubs. Leaves impari- or paripinnate, rarely digitate or reduced to one leaflet, unarmed or very spiny from the indurated leaf-rachises; stipules free or united to the leaf-rachis, rarely united into a sheath. Inflorescence various. Calyx with short nearly equal teeth. Corolla usually distinctly exserted; petals usually with long claws; keel incurved, obtuse. Stamens diadelphous, anthers uniform. Ovary sessile or stipitate; style incurved; stigma capitate. Pod various, usually turgid, continuous and much inflated or more or less completely longitudinally divided by a double membranous ingrowth from the dorsal suture. **DISTRIB.** Species about 1,200; mainly temperate in the Northern Hemisphere, with the head-quarters in Western and Central Asia; wanting in Australia.

Leaf-rachis ending in a leaflet.

Leaflets 17-25 glabrous or sparsely grey-silky 1. *A. Canolleanus*.

Leaflets 29-65 brown-silky.

Peduncles usually less than 1 inch long; a plant of alpine situations ... 2. *A. rhizanthus*.

Peduncles 1-9 inches long; a plant of hot dry hills ... 3. *A. pyrrhotrichus*.

Leaf-rachis ending in a spine.

Calyx sessile, narrowed equally to the base;
pod shorter than the calyx ... 4. *A. strobiliferus*.

Calyx pedicelled, gibbous at the base; pod
longer than the calyx ... *Sub-genus ÆGACANTHA*,
Bunge.

As the treatment of the species belonging to the section ÆGACANTHA in the Flora of British India is unsatisfactory and as many if not most of the species mentioned by Bunge occur in the Punjab especially in Kagan and Kinnawar I give below Bunge's key to the species likely to be met with. All of Bunge's species cannot probably be maintained but his classification seems to me better than that given in the Flora of Brit. Ind. where under *A. polyacanthus*, Royle, several plants differing widely in their flowers and habit are united. Without seeing Bunge's types many of which are in Kew I cannot be certain to which of Bunge's species the various forms met with in the Punjab belong and I have therefore omitted the species of this subgenus. None of them are of any forest importance.

I.—Leaflets pubescent, villous or silky on both sides—

A.—Leaflets 10-13 pairs—

- (i) Peduncle elongated, exceeding the flowers;
leaves narrow elliptic; spines slender ... *A. decemjugus*, Bge.
- (ii) Peduncle short, much shorter than the
flowers; leaves obcordate; spines rigid ... *A. zanskarensis*, Bth.

B.—Leaflets 3-9 pairs—

(i) Leaflets acute or pungent—

- (a) Brown-villous; leaflets about 8 pairs;
stipules membranous, spreading ... *A. licuspis*, Fisch.
- (b) Leaflets about 6 pairs; stipules erect—
 - (1) Leaflets minute, ovate, acute,
scarcely 2 lines long by $\frac{3}{4}$ line
broad ... *A. psilacanthus*, Boiss.
 - (2) Leaflets cuneate-spathulate, 7
lines long ... *A. cunefolius*, Bge.

(ii) Leaflets obtuse or emarginate—

- (a) Leaflets oblong 6-8 pairs; stipules
subherbaceous spreading; standard
panduriform; ovary stipitate ... *A. Grahamianus*, Royle.
- (b) Leaflets 4-6 pairs; stipules membra-
nous erect; ovary sessile—

(1) Leaflets sparsely hirsute; sti-
pules costate, sparsely hispid... *A. Jacquemontii*, Bge.

(2) Leaflets densely silky—

Standard angled at the base,
peduncles 1-7-flowered, calyx
subinflated; pod villous,
equalling the calyx ... *A. multiceps*, Royle.

Standard obovate-oblong gra-
dually narrowed into the
claw; flowers subsessile, sub-
solitary; pod with a long
beak ... *A. leptocentrus*, Bge.

II. —Leaflets glabrous above or on both sides—

A.—Stipules connate on the young shoots, at length tearing apart—

- (i) Calyx narrow-tubular glabrescent, teeth lanceolate; standard panduriform ... *A. Daltonianus*, Bge.
 (ii) Calyx turgid, teeth subulate; standard obtusely angled at the base, oblong ... *A. psilocentrus*, Fisch.

B.—Stipules free—

(i) Leaflets 8-13 pairs—

- (a) Leaflets 10-13 pairs; standard gradually narrowed into the claw; leaflets oblong obtuse; ovary sessile; wings shorter than the standard ... *A. cicerifolius*, Royle.
 (b) Leaflets 8-9 pairs; standard angled at the base; leaflets obcordate emarginate; ovary stipitate; wings equalling the standard ... *A. tenuispinus*, Bge.

(ii) Leaflets 3-6 pairs—

- (a) Calyx-teeth exceeding half the length of the tube; ovary subsessile; leaflets 5-7 pairs ... *A. raphiodontus*, Boiss.
 (b) Calyx-teeth one-fourth the length of the tube; ovary stipitate; leaflets 3-5 pairs ... *A. scariosus*, Bth.

1. *ASTRAGALUS CANDOLLEANUS*, Royle, *Illustr. Bot. Himal.* (1839) p. 199.—A suberect or prostrate shrub with flexible shoots, clothed rather sparsely with spreading grey hairs, internodes .2-1 inch long, not crowded. Leaves up to 5 inches long; stipules .4 inch long, membranous, free, costate. Leaflets 17-25, elliptic or oblong, .5 inch long, more or less silky hairy. Rachises persistent long after the fall of the leaflets but not spinescent. Flowers in heads, sessile or more or less peduncled, the peduncle sometimes lengthening in fruit to 2 inches. Pedicels .1-.2 inch long, bracts linear-lanceolate, exceeding the pedicels. Calyx .5 inch long, hairy; teeth linear, half as long as the tube. Corolla yellow, glabrous, standard 1 inch long, oblong, gradually narrowed into the claw; wings longer than the keel, shorter than the standard. Ovary densely hairy, stipitate. Pod .7-1 inch long, clothed with spreading silky hairs. *A. Royleanus*, Bunge.

Himalaya 10-13,000 feet, common in Kagan, Pangi and Kunawar. Flowers: June-July.

2. *ASTRAGALUS RHIZANTHUS*, Royle, *Illustr. Bot. Himal.* (1839) p. 200.—Stemless or frequently with the habit of *A. Candolleanus*, young shoots densely brown-silky. Internodes very short to nearly 1 inch long. Leaves variable, 2-8 inches long. Leaflets 29-65, more or less densely clothed with brown-silky hairs. Rachises deciduous in the stemless forms; more or less indurated and persistent in the long-stemmed varieties.

Pod .5-.7 inch long, clothed with grey spreading hairs. Otherwise as for *A. Candolleanus*. *A. Candolleanus* var. *pindreensis*, Bth. Fl. Brit. Ind. II, p. 133.

Himalaya 8-13,000 feet, common in Pangi and Kunawar. Perhaps not specifically distinct from *A. Candolleanus* from which it differs in the more numerous densely brown-silky leaflets, and somewhat smaller pod. As regards the elongate stems, Prain mss. remarks "this is the plant alluded to as *A. Candolleanus*, var. *pindreensis*, Bth. To me it looks like a form of *A. rhizanthus* with lengthened stems" a conclusion to which I had come before seeing this. *A. malacophyllus*, Bth., is also I think scarcely distinct. Flowers: June-July.

3. *ASTRAGALUS PYRRHOTRICHUS*, Boiss. *Diag. sér. 1*, IX (1849) p. 73.—A small shrub; stem stout, woody below, short, the upper portion densely clothed with soft spreading brown hairs, internodes up to .8 inch long, often very short. Leaves variable, 4-12 inches long or longer; rachis with soft spreading hairs, deciduous; stipules very variable, .3-1 inch long, lanceolate, silky. Leaflets usually 41-51, broadly elliptic, .2-.6 inch long, clothed with soft spreading brown hairs, apex obtuse with a small mucro or emarginate. Flowers in pedunculate contracted racemes; peduncle 1-9 inches long, clothed with brown spreading hairs. Pedicels .1 inch long; bracts linear-setaceous, much longer than the pedicels. Calyx .6-.8 inch long, densely silky; teeth setaceous, nearly as long as the tube. Corolla yellow; standard one and a half times as long as the calyx, slightly longer than the wings and keel. Ovary densely hairy, subsessile. Pod .7 inch long, densely brown-silky.

Low hills west of the Jhelum 2,000-6,000 feet. Not common. Trans-Indus. The woody stem is apparently only produced in some specimens. Flowers: April-May.

4. *ASTRAGALUS STROBILIFERUS*, Royle, *Illustr. Bot. Himal* (1839) p. 199.—A small much-branched stout woody shrub; twigs woolly, almost completely hidden by the overlapping stipules. Leaves 1-2 inches long; stipules brown, membranous, connate behind the rachis. Rachises persistent as stout sharp spines, erect or spreading. Leaflets 10-14, oblanceolate, .2 inch long, thick, glaucous, grey-silky, caducous, with a minute spiny mucro. Flowers few, sessile, in the axils of the petioles, scarcely exceeding the stipules. Calyx .25 inch long, cleft to the base, each lobe like a tuft of woolly pubescence. Corolla yellow, little exserted; petals equal, marcescent; standard panduriform. Pod shorter than the calyx, sessile, silky.

Himalaya 8-13,000 feet. Spiti, Kunawar. Not common.

10. *COLUTEA*, Linn.

(From *koloutea*, the name of a plant mentioned by Theophrastus. *DISTRIB.* Species 13; S. Europe and N. Africa to the Himalaya.)

COLUTEA NEPALENSIS, Sims, *Bot. Mag.* (1826) t. 2622.—An erect, deciduous, nearly glabrous shrub, young shoots pale

straw-colored, the epidermis peeling off in long narrow strips, older shoots smooth, brown. Leaves 2-6 inches long, imparipinnate, mostly clustered on very short dwarf shoots, rachis jointed at the base above the stipules; stipules .05 inch long, acute. Leaflets 9-13, the lateral opposite, .2-.5 inch long, obovate, usually retuse, entire, rather thick, dull-green, clothed when young with minute adpressed hairs, glabrous above when mature; petiolules minute, about .05 inch long. Flowers about .8 inch long, showy, yellow, often tinged with red, in lax, axillary, few-flowered racemes about as long as the leaves. Pedicels .3-.4 inch long, canescent; bracts .05 inch long, bracteoles minute. Calyx campanulate, .2-.3 inch long, hairy outside; teeth linear, acute, shorter than the tube, the two upper smaller than the rest. Corolla much exserted; standard suborbicular, notched, spreading, with two small thickened folds above the short claw; wings oblong with an auricle at the base above the claw; keel much incurved, auricled at the base and abruptly short-acuminate. Stamens diadelphous; anthers unifom. Ovary stipitate, pubescent; style filiform, much incurved, bearded along the inner side; stigma large, oblique. Pod 1.5-2 inches long, bladder-like, ovoid, membranous, splitting at the tip along the dorsal suture when mature. Seeds many, kidney-shaped. *C. arborescens*, Linn. var. *nepalensis*, Baker, in Fl. Brit. Ind. II, p. 103, *The Himalayan Bladder Senna*.

Himalaya 8-11,000 feet. Afghanistan to Nepal. Not common in the Punjab, but has been collected near Simla, at Matiana and in Kunawar. Flowers: July—August.

11. *MILLETTIA*, Wight and Arn.

(In honor of J. A. Millett, a French botanist of the 18th century. DISTRIB. Species 40-50; tropics of the Old World.)

MILLETTIA AURICULATA, Baker, *Fl. Brit. Ind.* II (1876) p. 108.—A large woody climber but more often seen as a suberect shrub. Leaves 1-2 feet long; petiole swollen at the base; stipules .3-.6 inch long, oblong, brown-velvety on the backs. Leaflets 7-9, the lateral opposite, 3-6 by 2-3.5 inches, obovate, elliptic or oblong, abruptly short-acuminate, entire, densely grey-silky when young, glabrous above when mature, paler and pubescent beneath; petiolules of the lateral leaflets .2 inch long; stipules setaceous, .1 inch long. Flowers .3-.4 inch long, dull-white, in slender axillary racemes, 4-12 inches long, rachis downy; pedicels clustered, .1 inch long; bracts minute, villous. Calyx .1 inch long, campanulate, brown-silky outside, teeth very short. Petals .3-.4 inch long, standard orbicular, brown-silky on the back with an in-folded auricle on either side of the claw; wings glabrous, a little longer than

the keel and adherent to it; keel brown-silky outside, incurved, obtuse. Stamens monadelphous, anthers uniform. Disk cup-shaped, thin, surrounding the base of the ovary and within the staminal-tube. Ovary sessile, densely silky; style filiform, incurved, glabrous; stigma capitate. Pod 4-7 by 1-1.5 inches, woody, brown-velvety, sutures thickened. Brandis, Ind. Trees, fig. 95.

Sub-Himalayan tract from the Ravi eastwards, common. A troublesome climber in the Sal forests of the United Provinces but not so in the Punjab where though common it is seldom seen as a climber. The bark gives a coarse fibre and pieces of the stem when beaten with the back of an axe make useful brushes for numbering trees. Flowers: May-June.

MILLETTIA OVALIFOLIA, Kurz.—A small deciduous tree. Leaflets 7, ovate-elliptic, 1-2 inches long. Flowers purple, in racemes 2-3 inches long, solitary or fascicled, appearing with the young leaves. Pod 2-3 inches long, linear-oblong, flat.

Indigenous to Burma. Cultivated in Lahore. Suffers somewhat from frost. Flowers: April.

12. TAVERNIERA, DC.

(In honor of J. B. Tavernier, a traveller in the Levant. *DISTRIB.* Species 7, closely related to one another; from Somaliland and Abyssinia to Western India.)

TAVERNIERA NUMMULARIA, Baker, *Fl. Brit. Ind.* II (1876) p. 140.—A twiggy shrub 2-3 feet high, twigs striate, densely adpressed silky-hairy. Leaves 3-foliate, one or both the lateral leaflets sometimes abortive, petiole channelled above, up to .8 inch long. Leaflets oblanceolate or obovate, up to .8 by .3 inch, thick, quite entire, mucronate, densely silky when young, ultimately glabrous above; stipules connate, amplexicaul. Flowers in axillary racemes up to 4 inches long; pedicels .1 inch long, bracts lanceolate, equalling the pedicels. Calyx .2 inch long, densely silky; teeth deltoid, cuspidate, shorter than the tube. Corolla purple, .5 inch long, marcescent, standard and keel much exceeding the wings, keel-petals obtuse with a big auricle. Stamens monadelphous, anthers uniform. Ovary stalked; style long, inflexed; stigma minute, capitate. Pod jointed, joints 1-3, rounded, indehiscent, hairy and echinate.

Rawalpindi District in dry places, Cambellpur, Hazara, Trans-Indus. Flowers: April. Not common as a rule but fairly frequently near Punjar on dry bare stony ridges.

[The above description is based on the Punjar plant and on Aitchison's Nos. 380, 146 all from the Rawalpindi District. It does not cover specimens from Sind and Baluchistan also referred to *T. nummularia*, DC., of the *Fl. Brit. Ind.* which is a collective species, some of the forms included under it having yellow flowers.]

13. EBENUS, Linn.

(The Latin for ebony. *DISTRIB.* Species 14; from the Mediterranean to the Indus.)

EBENUS STELLATA, Boiss. *Diag. sér. 1*, II (1843) p. 100.—A shrub about 1 foot high, densely tufted, armed with numerous

erecto-patent stout but flexible spines, all parts densely adpressed grey- or brown-silky. Petioles either naked and spine-scent up to 2 inches long, persistent, or bearing leaflets and deciduous, .5-1 inch long. Leaflets 3, digitate, rarely 5 or reduced to 1, up to 1 by .2 inch, linear or lanceolate, quite entire, coriaceous, with a spinescent tip, densely adpressed silky on both sides; stipules amplexicaul, united but with free spinescent tips. Flowers in dense axillary peduncled heads; peduncle 2-3 inches long, flowers surrounded by an involucre of lanceolate spine-tipped bracts; pedicels 0. Calyx .5 inch long, densely clothed with long brown silky hairs; teeth setaceous, plumose, exceeding the tube. Corolla red, shorter than the calyx, keel equalling the standard, wings short. Stamens monadelphous, the upper free at the base, anthers uniform. Ovary sessile; style filiform incurved; stigma capitate; ovule 1. Pod flat, oblong, membranous, included in the calyx-tube, indehiscent.

Trans-Indus; Baluchistan. There is a sheet in Herb. Dehra which is said to have come from the Siran valley, Hazara. Flowers: May.

14. ALHAGI, Desv.

(Derived from the Arabic name for one of the species. **DISTRIB.** Species 2-3; from Greece and Egypt to Central India.)

ALHAGI CAMELORUM, *Fisch. Ind. Hort. Gorenk. ed. 2* (1812) p. 72.—An undershrub, up to 2-3 feet high; twigs woody, glabrous or puberulous, striate, armed with sharp thorns. Leaves simple, very variable, up to 1 inch long, obovate or elliptic-oblong, coriaceous, glabrous or puberulous, quite entire, apiculate; petiole very short, stipules minute. Flowers 3-8 on the thorns, red; pedicels very short. Calyx .1 inch long, glabrous; teeth triangular, much shorter than the tube. Corolla twice to thrice as long as the calyx; standard obovate-oblong, auricled at the base above the claw, wings and keel about as long as the standard: keel incurved obtuse. Stamens diadelphous, anthers uniform. Ovary nearly sessile, glabrous; style filiform, incurved; stigma terminal, small. Pod glabrous up to 1 inch long, more or less contracted between the seeds, indehiscent. Seeds 1-several. *Alhagi Maurorum*, Baker, in Hook. f. *Fl. Brit. Ind. II*, p. 145. *Camel Thorn*. Vern. Jousa.

Dry places in the plains, Salt Range. Not common as a rule but abundant locally. Sends up leafy branches in the hot weather which die down again after the rains. Flowers: May. The plant is used as fodder for camels whence the English name.

15. LESPEDeza, Mchx.

(In honor of D. Lespedez, a Governor of Florida in the 18th century and a patron of botany.)

Herbs, undershrubs or shrubs, usually softly hairy. Leaves pinnately trifoliate, rarely 1-foliate, with or without stipels. Flowers purple, rosy or white, usually in axillary racemes or clusters, less often in terminal panicles. Calyx-teeth small,

subequal. Petals clawed; standard oblong or obovate, wings oblong-falcate, free or loosely adnate to the keel; keel incurved, obtuse or beaked. Stamens diadelphous; anthers uniform. Ovary sessile or stipitate; ovule 1; style slender, incurved; stigma small, terminal. Pod ovate, somewhat compressed, often reticulate, indehiscent. **DISTRIB.** Species 33; temperate N. America and East Asia and the mountains of tropical Asia and Australia.

Sub-genus **ARCHILESPEDA**. Keel nearly straight, blunt.

Flowers clustered or in shortly peduncled umbels.

Calyx .1 inch long; corolla .3 inch long ... 1. *L. sericea*.

Calyx .3 inch long; corolla .5 inch long ... 2. *L. Gerardiana*.

... 3. *L. floribunda*.

Flowers in racemes

Sub-genus **CAMPYLOTRIPIS**. Keel incurved, pointed.

Racemes sessile; bracts persistent ... 4. *L. stenocarpa*.

Racemes peduncled.

Bracts equalling the pedicels, mostly deciduous ... 5. *L. eriocarpa*.

Bracts much shorter than the pedicels, persistent ... 6. *L. dubia*.

1. **LESPEDA SERICEA**, *Miq. Ann. Mus. Lug. Bat.* III (1867) p. 49.—An undershrub sending up annual shoots up to 3 feet long from a woody rootstock, twigs woody, slender, tough, suberect or prostrate, striate, more or less densely grey-pubescent. Leaves trifoliate, crowded; petiole up to .15 inch long, usually very short; stipules linear-subulate, persistent, .1 inch long or less. Leaflets .3-.8 inch long, oblanceolate, linear-cuneate or linear-oblong, apex rounded or truncate, mucronate, entire, glabrous or nearly so above, densely grey-silky beneath; petioles minute. Flowers 2-4 in dense axillary clusters, sessile or shortly peduncled. Peduncle usually suppressed, sometimes .15-.5 inch long. Pedicels 0-.1 inch long; bracts and bracteoles minute. Calyx .1 inch long, pubescent; teeth linear-subulate, much exceeding the tube. Corolla nearly twice the calyx, pale-yellow or pink; keel slightly incurved, obtuse. Pod .1 inch long, thinly silky, about as long as the calyx. *L. juncea*, Baker, in *Fl. Brit. Ind.*

Himalaya ascending to 8,000 feet. An extremely common plant occurring in grassy forest undergrowth at lower elevations and on hot grassy exposed slopes at the higher elevations. Flowers: July—August.

2. **LESPEDA GERARDIANA**, *Grah. in Wall. Cat.* (1828) No. 5744.—Habit of *L. sericea* but somewhat more erect and shoots less branched. Umbels usually sessile, 4-8-flowered, sometimes with a peduncle 1 inch long. Bracts linear, half as long

as the calyx. Calyx .3 inch long densely silky; teeth linear-subulate, much exceeding the tube. Corolla .5 inch long, pale yellow; keel tipped with purple. Pod .1 inch long, grey-tomentose, much shorter than the calyx. Collett, Fl. Siml., fig 38.

Himalaya 5-10,000 feet from Kashmir and Chamba eastwards. Flowers: August to October.

3. *LESPEDeza FLORIBUNDA*, Bunge, *Pl. Mongh-Chin.* (1835) p. 13.—A slender erect shrub 2-3 feet high, stem persistent and woody below, twigs slender pubescent striate. Leaves trifoliate; petioles .5-1 inch long, slender, channelled above and patently hairy; stipules setaceous, persistent, .2 inch long. Leaflets up to 1 by .7 inch, elliptic or obovate, apex blunt or retuse, mucronate, entire, lateral nerves numerous, equal, almost all reaching the margin of the leaflet, clothed sparsely with very fine adpressed grey-silky hairs above, paler and more hairy beneath; stalk of the terminal leaflet .2-.3 inch long, petiolules of the lateral minute. Racemes numerous, axillary, towards the ends of the branches, 1-1.5 inches long, equalling or exceeding the upper leaves. Flowers in rather distant pairs; pedicels up to .1 inch long; bracts and bracteoles minute. Calyx .2 inch long, teeth lanceolate, exceeding the tube. Corolla pale-purple, .4 inch long; keel slightly incurved, blunt. Pod .25 inch long, elliptic, adpressed grey-silky with dark reticulate veins when mature. *L. bicolor*, Prain, in Journ. As. Soc. Beng., 66 (1897), p. 377, non Turczaninow, fide Schindler.

Hazara District. In the Kagan Valley from Malkandi to Diwan Bela, 5-6,000 feet, very common. Also Kashmir. Flowers: August. (Duthie's No. 7,460 from the Black Mountain mentioned by Prain l.c. does not belong here.)

4. *LESPEDeza STENOCARPA*, Maxim. *Synops. Lesped.* (1873) p. 23.—An erect woody shrub 3-5 feet high, twigs densely tomentose with spreading hairs. Leaves trifoliate; petiole .2-1 inch long, densely hairy; stipules deltoid, acuminate, striate, persistent, .1 inch long. Leaflets up to .7 by .5 inch, cuneate-obovate or obovate, apex obtuse, truncate or retuse, often minutely mucronate, thick, entire, glabrous above, densely grey or silvery-silky beneath; stalk of the terminal leaflet .2 inch long or less, petiolules of the lateral minute. Racemes axillary, under 1.5 inches long, dense, catkin-like when unexpanded and very silky, flowered from the base. Bracts ovate, persistent, very silky. Pedicels densely clothed with spreading silky hairs, .15-.3 inch long, usually exceeding the bracts. Calyx .2 inch long, very silky; teeth lanceolate, twice as long as the tube. Corolla .4 inch long, dark-red; keel sharply incurved, acute. Pod .5 inch long, oblong, gradually narrowed into the

persistent base of the style, sutures patently silky, faces adpressed pubescent, reticulate. *L. macrostyla*, Baker, Fl. Brit. Ind. *ex parte*.

Himalaya from the Sutlej eastwards ascending to 5,000 feet. Flowers : April-May, at times at other seasons. Not common in the Punjab but occurs on hot dry slopes *e.g.*, near Massarna in Bashahr, also near Simla.

5. *LESPEDeza ERIOCARPA*, DC. *Prodr.* II (1825) p. 349.—A tall erect shrub up to 6 feet high, twigs ribbed, densely adpressed grey pubescent. Leaves trifoliate; petiole $\cdot 5\text{--}1\cdot 5$ inches long, broadly channelled above, finely adpressed pubescent; stipules lanceolate, striate, persistent, $\cdot 2\text{--}2\cdot 25$ inch long. Leaflets up to $1\cdot 8$ by $\cdot 9$ (rarely less than $\cdot 7$ inch long) elliptic or obovate, apex rounded with rather a long mucro, rarely slightly retuse, base rounded or more or less cuneate, dark-green and glabrous above, glaucous beneath, with fine adpressed silky hairs, main lateral nerves with finer nerves between which anastomose before reaching the margin; stalk of the terminal leaflets up to $\cdot 5$ inch long, petiolules of the lateral $\cdot 05\text{--}1$ inch long. Flowers in peduncled, not dense, axillary racemes up to 6 inches long. Bracts ovate, pubescent on the back, striate within, $\cdot 1$ inch long, mostly deciduous. Pedicels minutely hairy, $\cdot 1$ inch long. Calyx $\cdot 2$ inch long, adpressed pubescent; teeth linear-subulate, slightly exceeding the tube. Corolla $\cdot 4\text{--}\cdot 5$ inch long, deep-purple; keel much incurved, pointed. Pod $\cdot 3\text{--}\cdot 4$ inch long, mucronate, adpressed grey hairy. *L. indica*, Schindler, in Fedde, Rep. Spec. Nov. 1911, p. 515; *L. speciosa*, Royle, apud Maxim. Schindler l. c., p. 519.

Himalaya from Dalhousie eastwards, 4-7,000 feet. Flowers : August-September. Fairly common on banks, etc.

6. *LESPEDeza DUBIA*, Schindler, in Fedde, Rep. Spec. Nov. IX (1911) p. 514.—An erect shrub 2-4 feet high, twigs slender, densely grey pubescent. Leaves trifoliate; petiole up to $2\cdot 5$ inches long (towards the inflorescence $\cdot 5$ inch long or less), flattened or broadly channelled above, densely adpressed hairy; stipules $\cdot 15\text{--}\cdot 25$ inch long, lanceolate, acuminate or linear-subulate, persistent. Leaflets elliptic, orbicular or broadly obovate, up to $1\cdot 4$ by $1\cdot 2$ inches, base rounded, apex usually retuse, mucronate, entire, glabrous above, thinly adpressed hairy beneath, main lateral nerves running to the leaf-margin with finer anastomosing nerves between; stalk of the terminal leaflet $\cdot 5$ inch long, petiolules of the lateral $\cdot 05$ inch long. Flowers in lax axillary peduncled racemes 3-6 inches long, paniced towards the ends of the branches by the suppression of the subtending leaves; peduncle up to 3 inches long. Pedicels $\cdot 25\text{--}\cdot 4$ inch long, clothed thinly with spreading pubescence. Bracts persistent, less than $\cdot 1$ inch long. Calyx $\cdot 2$ inch long,

densely silky; teeth linear-lanceolate, slightly exceeding the tube. Corolla purplish-blue, .4 inch long; keel much incurved, pointed. Pod .4 inch long, beaked with the persistent style-base which is nearly .1 inch long, faces adpressed grey-hairy, reticulate, sutures with spreading hairs. *L. eriocarpa*, DC. var. *Falconeri*, Prain, l. c., p. 376; *L. Meeboldii*, Schindler, l. c., p. 521.

Himalaya 4-7,000 feet from the Indus eastwards. Common in Hazara on rocks, Murree Hills, Chamba. In Simla less common than *L. eriocarpa*, DC. Flowers: July-September.

16. URARIA, Desv.

* (From the Greek *oura*, a tail; referring to the inflorescence.)

Herbs or undershrubs. Leaves pinnately 3-9-foliolate, or sometimes 1-foliolate; stipules free, acuminate, striate. Leaflets stipellate. Flowers in terminal racemes; bracts ovate or lanceolate, acuminate; bracteoles 0. Calyx-tube short, teeth subulate, the two upper shorter than the rest. Corolla purple or yellow, petals clawed; standard obovate or orbicular; wings falcate-oblong; adhering to the keel; keel slightly incurved, obtuse. Stamens diadelphous; anthers uniform. Ovary sessile or shortly stipitate; ovules 2-many; style filiform, inflexed; stigma small, terminal. Pod of 2-6 small, turgid, 1-seeded joints, folded on one another within the calyx. **DISTRIB.** Species 15; tropical Asia, Africa and Australia.

Upper leaves 5-9-foliolate

... 1. *U. picta*.

Leaves 1-3-foliolate.

Lower calyx-teeth elongate; pod hairy ... 2. *U. lagopus*.

Calyx-teeth sub-equal; pod glabrous ... 3. *U. neglecta*.

1. *URARIA PICTA*, Desv. *Journ. Bot.* 1 (1813) p. 123, t. 5, fig. 19.—A sparingly branched, erect shrubby perennial about 3 feet high, stems rather stout, pubescent. Leaves 4-12 inches long, the lowest 1-3-foliolate; stipules .5 inch long, lanceolate, acuminate. Leaflets (of the upper leaves) 5-9, the lateral opposite, 3-8 by .4-1 inch, linear-oblong, firm, subcoriaceous, blotched with white above along the midrib, glabrous above, minutely pubescent with prominent nerves beneath; petiolules .05-.1 inch long, stout, tomentose; stipels longer than the petiolules, linear-cuspidate or subulate. Flowers .25 inch long, purple, in close fascicles along the rachis of a spicate, cylindric, erect, terminal raceme 6-12 inches long. Bracts .4-.7 inch long, the upper lanceolate-acuminate, the lower ovate-acuminate, completely concealing the buds, caducous; pedicels .2-.3 inch long, downy and bristly with hooked hairs, abruptly upcurved after flowering so that the pods are in contact with the rachis. Calyx .2 inch long, teeth plumose,

unequal. Corolla $\cdot 3$ inch long. Pods glabrous, pale lead-colored or whitish, joints 3-6, smooth, polished.

Sub-Himalayan tract and Lower Himalaya from Kashmir eastwards. Flowers : June-August.

2. *URARIA LAGOPUS*, *DC. in Ann. Soc. Nat. sér. 1, IV* (1825) p. 100.—An erect undershrub, stem, rachis and especially the inflorescence bristly and pubescent. Leaves 1- and 3-foliate; petiole 2-4 inches long; stipules $\cdot 3\text{--}\cdot 4$ inch long, cuspidate-acuminate, from a broad cordate base. Leaflets 1.5-4.5 inches long, ovate or oval, obtuse or emarginate, mucronate, entire, more or less scabrous above, paler beneath and pubescent on the nerves; petiolules $\cdot 05\text{--}\cdot 1$ inch long, densely bristly; stipules as long as the petiolules, triangular, acute. Flowers $\cdot 3$ inch long, purple, in cylindric, sometimes paniced racemes 6-12 inches long. Bracts $\cdot 3$ inch long, ovate-acuminate, densely ciliate, completely concealing the buds, caducous; pedicels $\cdot 3\text{--}\cdot 4$ inch long, incurved at the tips after flowering. Calyx $\cdot 2$ inch long, teeth plumose, unequal. Corolla $\cdot 3$ inch long. Pods hairy, 2-6-jointed.

Outer Himalaya from the Punjab eastwards ascending to 6,000 feet. I have seen no Punjab specimens, the distribution given is according to Duthie who has perhaps followed the *Fl. Brit. Ind.* where this species includes *U. neglecta*, Prain. The plant has been collected in Garhwal and Dehra Dun so may be expected to occur in the East Punjab. Flowers : September.

3. *URARIA NEGLECTA*, *Prain, Journ. As. Soc. Beng. LXVI, 2* (1897) p. 382.—Petiole $\cdot 5\text{--}2$ inches long, stipules lanceolate-acuminate, stipels linear-cuspidate. Bracts hairy. Calyx-teeth subequal. Pods glabrous. Otherwise as for *U. lagopus*.

Himalaya ascending to 6,000 feet and Sub-Himalayan tract from the Ravi and Chamba eastwards. Flowers : August-September.

17. *OUGEINIA*, Benth.

(From Ujjain, a town in Central India whence seeds were sent in 1795 to Dr. Roxburgh at the Calcutta Botanic Gardens. *DISTRIB.* Species only the following.)

OUGEINIA DALBERGHIODES, *Benth. Pl. Jungh.* (1851-1855) p. 216.—A medium-sized deciduous tree, more often seen as a shrub; bark thin, grey or light-brown, nearly smooth; twigs angular or striate. Leaves pinnately trifoliate; petiole 2-6 inches long, channelled above, swollen at the base; stipules lanceolate, acute, caducous, $\cdot 1\text{--}\cdot 2$ inch long. Leaflets, the lateral opposite, 2.5-4.5 by 1.5-3 inches, obliquely ovate, the terminal 3-6 by 2.3-5 inches, broadly ovate, or rounded, sometimes trapezoidal; all entire or sinuate, subcoriaceous, glabrous above, downy or glabrescent beneath; petiolules $\cdot 1\text{--}2$ inch long; stipels subulate, $\cdot 1$ inch long. Flowers $\cdot 3\text{--}\cdot 4$ inch long, white or rosy, appearing when the tree is leafless or nearly

so in short fascicled racemes from the nodes of the old branches; pedicels .5-.8 inch long, filiform, usually fascicled; bracts .05 inch long, ovate, acuminate, villous; bracteoles 1 or 2 at different levels beneath the calyx, minute, villous. Calyx .1-.15 inch long, pubescent, campanulate; teeth triangular, obtuse, shorter than the tube, the two upper connate, the lowest the longest. Standard suborbicular, clawed; wings oblong; keel obtuse. Stamens diadelphous; anthers uniform. Ovary sessile; style incurved, subulate; stigma terminal, capitate. Pod 2-4 by .3 inch, flat, jointed, joints reticulately veined, 2-3 times as long as broad. Vern. *Sannan*, *Sandan*.

Himalaya ascending to 4,000 feet and Sub-Himalayan tract from the Ravi eastwards, common. The *Sandan* is an important tree in the United and Central Provinces, in the Punjab it is rarely seen more than 1 foot in diameter and is usually shrubby. Often more or less gregarious and producing root-suckers in abundance. The wood is hard, strong, tough and durable and useful for furniture, building, agricultural implements &c. The heartwood is brown and takes a fine polish. On good soil and when cultivated the *Sandan* reaches a girth of 6 feet or more and a height of 50 feet. A well grown specimen in flower is very handsome but it is not grown in gardens in the Punjab. The leaves are lopped for fodder. Flowers: March—May.

18. DESMODIUM, Desv.

(From the Greek *desmos*, a chain, referring to the jointed pods.)

Herbs or shrubs. Leaves pinnately 1-3-foliolate, stipellate. Flowers small, usually in racemes, pedicels usually clustered at the nodes. Calyx-tube short, teeth various. Corolla exserted: standard oblong, obovate or orbicular; wings more or less adhering to the obtuse keel. Stamens diadelphous, upper stamen entirely or partially free; anthers uniform. Ovary sessile or stipitate, 2-many-ovuled; style incurved; stigma minute, capitate. Pod exserted from the calyx, sessile or stalked, usually composed of 1-several, 1-seeded indehiscent, joints, fragile, sometimes the joints scarcely separating and the pod dehiscing as a whole along the lower suture. DISTRIB. Species about 150; tropics of both hemispheres, a few in North America and South Africa.

Leaves trifoliolate.

Pod not bent at right angles to its stalk, usually sessile.

Flowers half an inch long or nearly so.

Racemes much-branched, flowers pale lilac 1. *D. tiliaefolium*.

Racemes lax drooping little-branched,
flowers dark-purple ... 2. *D. nutans*.

Flowers .3 inch long or less (up to .4 inch in
D. sambuense).

Bracts minute.

Twigs brown-tomentose, leaves pubescent
above ... 3. *D. sequax*.

Twigs adpressed hairy when young, leaves
glabrescent above when mature ... 4. *D. laxiflorum*.

Bracts : 2 inch long or longer.

Petiole 1-2·5 inches long ... 5. *D. sambuense*.

Petiole not exceeding 1 inch long.

Leaves adpressed silky above ... 6. *D. concinnum*.

Leaves glabrous above ... 7. *D. polycarpum*.

Pod stalked and bent at right angles to its stalk.

Terminal leaflets orbicular, obtuse or abruptly shortly acuminate ... 8. *D. podocarpum*.

Terminal leaflets ovate or lanceolate, acuminate ... 9. *D. oxyphyllum*.

Leaves simple.

Petiole winged ... 10. *D. pseudotriquetrum*.

Petiole not winged.

Leaves entire, glabrescent above ... 11. *D. gangeticum*.

Leaves repand, hispid above ... 12. *D. latifolium*.

1. *DESMODIUM TILIÆFOLIUM*, G. Don, Gen. Syst. II (1832) p. 297.—A large deciduous shrub 6-8 feet high and 2 inches diameter at the base, twigs striate more or less densely pubescent. Leaves trifoliate; petiole up to 3 inches long; stipules narrow-linear, ·2 inch long, caducous. Leaflets variable, the terminal up to 3 inches long, orbicular, ovate or obovate, base cuneate or rounded, apex obtuse or abruptly short-acuminate, margins sinuate, glabrous or sparsely hairy above, glabrous or tomentose beneath with silky hairs, the lateral slightly smaller, oblique, more rounded at the base and sometimes more gradually pointed; stalk of the terminal leaflet ·5-1 inch long, petiolules of the lateral ·1-·2 inch long. Flowers in large terminal much-branched panicles often 12 inches long, the lower branches in the axils of leaves, panicle-branches racemose with the flowers usually clustered. Pedicels slender, ·2-·3 inch long; bracts lanceolate, ·1 inch long, bracteoles linear, small. Calyx ·1 inch long, downy; teeth deltoid; shorter than the tube. Corolla ·4-·5 inch long, pale-lilac; standard orbicular, abruptly narrowed into a very short claw. Pod sessile or distinctly stalked by the abortion of the lower ovules, 2-2·5 by ·25 inch, upper suture straight or slightly undulate, lower indented between the seeds, joints ·25-·3 inch long, thinly adpressed hairy. *D. serriferum*, Wall. Vern. *Chamkât*, *Chamra* (Haz.).

Himalaya 3-9,000 feet, very common in open forest and shrubby places. Flowers : June—September. Also Trans-Indus. A very variably plant. *D. argenteum*, Wall. is a form with rugose almost coriaceous leaves very densely villous beneath which should perhaps be referred to *D. nutans*, Wall. *D. serriferum*, Wall. is a form with narrower acuminate leaflets.

2. *DESMODIUM NUTANS*, Wall. Cat. (1828) No. 5706.—

A large shrub with arching branches, twigs striate, densely grey pubescent or tomentose. Leaves trifoliate; petiole up to 2 inches long; stipules .2 inch long, subulate, caducous. Leaflets as in *D. tiliaefolium* but more rounded at the apex, thicker and densely grey tomentose beneath. Inflorescence a long arching little-branched terminal panicle often 18 inches long, branches lax, racemose, flowers clustered or on very short slender lateral axes. Pedicels very slender, up to .5 inch long. Calyx villous. Corolla dark-purple. Pod densely pubescent with short hairs, both sutures distinctly indented between the seeds. Otherwise as for *D. tiliaefolium* (with which it is united in the !l. Brit. Ind.).

Himalaya 4-7,000 feet. Flowers: June to September. Chamba and Bashahr. Very common and gregarious in Bashahr on open hot grassy hillsides. This plant is easily recognised in the field by its long lax drooping panicles and dark purple flowers, but in the herbarium it is scarcely distinguishable from some forms of *D. tiliaefolium* with which any botanist who did not know the living plant would probably unite it.

3. *DESMODIUM SEQUAX*, Wall. Pl. As. Rar. II (1831)

t. 157.—A tall erect shrub, twigs brown-tomentose. Leaves trifoliate; petiole 1 inch long, channelled, pubescent; stipules lanceolate, striate .1 inch long, caducous. Leaflets up to 4 by 2.5 inches, ovate or ovate-lanceolate, base rounded, apex acute or acuminate, margin sinuate, dark-green and minutely adpressed hairy above, glaucous beneath and clothed with short adpressed hairs; lateral leaflets smaller, slightly oblique; stalk of the terminal leaflet .5 inch long, petiolules of the lateral .1 inch long; stipels setaceous, nearly .1 inch long. Flowers in axillary and terminal panicles, branches racemose, flowers solitary or in pairs. Pedicels .2 inch long, pubescent, bracts minute. Calyx .1 inch long, pubescent; teeth deltoid, as long as the tube. Corolla .2-.3 inch long, pink. Pod .5-1.5 by .1 inch, both sutures indented between the seeds, joints .1 inch long, densely clothed with minute brown hooked hairs. Seeds 6-12.

Himalaya 4-6,000 feet from Simla eastwards. Not common. Flowers August—September.

4. *DESMODIUM LAXIFLORUM*, DC. Prodr. II (1825) p.

335.—An erect undershrub 2-3 feet high, twigs woody, furrowed or striate, adpressed hairy when young. Leaves trifoliate; petiole 1-2.5 inches long, channelled, pubescent; stipules .3-.5 inch long, erect, lanceolate, cuspidate, costate. Leaflets up to 5 by 2.5 inches, ovate or broadly lanceolate, base narrowed or rounded, apex acute, entire, thin, membranous, green above and thinly clothed with long fine adpressed hairs when young, glabrescent when mature, glaucescent beneath and clothed

with fine adpressed silky grey hairs; lateral leaflets smaller, slightly oblique; stalk of the terminal leaflet .5-1 inch long, petiolules of the lateral .1 inch long; stipels .2 inch long, setaceous. Flowers in terminal and axillary racemes 6-10 inches long, pedicels very slender, .2-.3 inch long, usually clustered, bracts minute. Calyx .1 inch long, hispid; teeth lanceolate, slightly exceeding the tube. Corolla .25 inch long. Pod 1-1.5 by .1 inch, both sutures slightly undulate, joints .15-.2 inch long, clothed with minute hooked hairs. Seeds 6-10.

Himalaya and Sub-Himalayan tract from Kashmir eastwards, ascending to 6,000 feet. Flowers: August—September.

5. *DESMODIUM SAMBUENSE*, DC. *Prodr.* II (1825) p. 335.—An erect shrub, twigs angular, clothed especially on the angles with ascending grey silky hairs. Leaves trifoliate; petiole 1-2.5 inches long, densely hairy; stipules .3 inch long, lanceolate, persistent, striate, ciliate. Leaflets up to 3 by 2 inches, ovate or obovate, dark-green and glabrescent above, glaucous and more or less densely adpressed silky hairy beneath, entire, usually rounded at both ends and often with a long mucronate point; lateral leaflets slightly oblique; stalk of the terminal leaflet .5 inch long, petiolules of the lateral .1 inch long; stipels lanceolate, nearly .1 inch long. Flowers in axillary and terminal panicles, branches racemose with the flowers solitary or in pairs. Pedicels .2 inch long; bracts lanceolate, acuminate, ciliate, .25 inch long. Calyx .15 inch long, sparsely silky; teeth as long as the tube. Corolla .3-.4 inch long, white or pink. Pod .7-1 by .1 inch, upper suture slightly or distinctly indented, the lower deeply indented, joints .1-.15 inch long, densely brown adpressed hairy. Seeds 6-8. *D. floribundum*, G. Don, Collett, Fl. Siml., fig. 39.

Himalaya 5-7,000 feet from the Ravi eastwards, common, Flowers: June—September.

6. *DESMODIUM CONCINNUM*, DC. *Prodr.* II (1825) p. 335.—A tall slender shrub reaching 6-8 feet, branches drooping, twigs glabrous or thinly pubescent, dark purplish-brown. Leaves trifoliate, one or both the lateral leaflets occasionally wanting; petiole up to 1 inch long; stipules erect, .3-.5 inch long, persistent, lanceolate, cuspidate, striate. Leaflets up to 3 by 1.2 inches, elliptic-oblong, rounded at both ends, usually mucronate, entire, clothed on both sides with very fine adpressed silky hairs, pale and glaucescent beneath, lateral nerves 7-10 pairs, prominent beneath; stalk of the terminal leaflet .3 inch long, petiolules of the lateral .05 inch long; stipels setaceous, .2 inch long. Flowers in long slender axillary and terminal drooping racemes. Pedicels usually in pairs, slender, .3-.5

inch long; bracts .25 inch long, lanceolate, acuminate, ciliate, striate, closely imbricated. Calyx .1 inch long; teeth deltoid, as long as the tube. Corolla blue, .3 inch long. Pod .5-.7 inch long, less than .1 inch wide, distinctly stalked, upper suture wavy, lower deeply indented between the seeds, joints .1 long, minutely hairy. Seeds 1-6.

Along the foot of the Himalaya from Hazara eastwards ascending to 6,000 feet. Common, but not gregarious. The leaflets often have a cloudy band along the midrib. Flowers: August—September.

7. *DESMODIUM POLYCARPUM*, DC. *Prodr.* II (1825) p. 334, var. *TRICHOCAULON*, Baker, in *Fl. Brit. Ind.* II, p. 172.---A small suberect or prostrate undershrub with woody striate twigs clothed with long spreading grey silky hairs. Leaves trifoliate; petiole up to 1 inch long, often .5 inch or less; stipules erect, persistent, lanceolate, acuminate, striate, .3-.5 inch long. Leaflets .5-1.5 inches long, suborbicular, broadly elliptic or obovate, rounded at both ends, often retuse, dark-green and glabrous above, glaucous and adpressed silky hairy beneath; stalk of the terminal leaflet up to .3 inch long, petiolules of the lateral .05 inch long; stipels setaceous, .05-.1 inch long. Flowers in axillary and terminal rather dense racemes up to 3 inches long. Pedicels .2 inch long, ascending; bracts ovate, acuminate, striate, .2 inch long. Calyx .1 inch long; teeth broad, acuminate, exceeding the tube. Corolla .2 inch long, purple. Pod .5-.8 by .1 inch, upper suture straight, lower indented, joints .1 inch long, clothed especially on the sutures with minutely hooked rusty hairs. Seeds 4-8. *D. trichocaulon*, DC. l.c. p. 335.

Along the base of the Himalaya from Kangra eastwards ascending to 5,000 feet. Flowers: July—August. The type is a more erect plant with the twigs clothed with adpressed hairs, bracts smaller and racemes more densely flowered. It has not been collected in the Punjab.

8. *DESMODIUM PODOCARPUM*, DC. *Prodr.* II (1825) p. 336.—An erect undershrub 2-4 feet high, twigs woody, striate, pubescent, dark-brown. Leaves trifoliate; petiole up to 3 inches long; stipules .3 inch long, setaceous deciduous. Leaflets up to 3 inches long, orbicular, base cuneate, apex obtuse or abruptly short-acuminate, entire, thin, membranous, dark-green, above, glaucous beneath, thinly adpressed silky on both sides when young, ultimately glabrescent; the lateral leaflets smaller, somewhat narrower, oblique; stalk of the terminal leaflet up to 1 inch long, petiolules of the lateral .1 inch long; stipels setaceous, .1 inch long. Flowers in axillary and terminal lax racemes often 1 foot long. Pedicels solitary or 2-3 together, very slender, .2 inch long; bracts minute, linear. Calyx .05 inch long, thinly hairy; teeth broad, shorter than the tube, Corolla .15 inch long. Pod bent nearly at right angles to its

stalk which is almost .2 inch long, 1-2-jointed, each joint .3 inch long, .15 inch wide, upper suture slightly depressed in the centre of the joint, lower suture gently curved in the lower portion of the joint and then abruptly curved upwards to meet the upper suture, sutures thick, glabrous, the upper flattened on top, faces of the joints pubescent.

Himalaya from the Indus eastwards ascending to 9,000 feet. Flowers: July—August.

9. *DESMODIUM OXYPHYLLUM*, DC. *Prodr.* II (1825) p. 336.—An erect undershrub, twigs woody, striate, pubescent, dark brown. Leaves trifoliate; petiole up to 3 inches long; stipules .3 inch long, setaceous, deciduous. Leaflets ovate or lanceolate, the terminal about 2-3 by 1-1.5 inches, base cuneate, apex gradually narrowed from below the middle to an acute point, entire or undulate, thin, membranous, dark-green above, glaucous beneath, thinly adpressed silky on both sides when young, ultimately glabrescent; the lateral leaflets somewhat smaller, oblique; stalk of the terminal leaflet up to .7 inch long, petioles of the lateral .1 inch long; stipels setaceous, .1 inch long. Flowers in axillary and terminal lax racemes often 1 foot long. Pedicels solitary or 2-3 together, very slender, .2 inch long; bracts minute, linear. Calyx .05 inch long, thinly hairy; teeth broad, shorter than the tube. Corolla .15 inch long. Pod bent nearly at right angles to its stalk which is .15 inch long, 1-2 jointed, each joint .3 inch long, .15 inch wide, upper suture slightly depressed in the centre of the joint, lower suture gently curved in the lower portion of the joint and then abruptly curved upwards to meet the upper suture, sutures thick, glabrous, the upper flattened on top, faces of the joints pubescent. *D. podocarpum*, Baker, in Fl. Brit. Ind. II, p. 165 *ex parte* not *D. oxyphyllum*, Baker, l. c. p. 167.

Himalaya 4-6,500 feet, Chamba. Sirmur. Not common. Garhwal, Kumaon eastwards to China. For the confusion which has arisen over this species *vide* Prain, Journ. As. Soc., Beng., LXVI, 2, p. 393. Flowers: July—August.

10. *DESMODIUM PSEUDOTRIQUETRUM*, DC. *Prodr.* II (1825) p. 326.—An undershrub, branches 1-3 feet long, woody, erect, or prostrate. Twigs triquetrous, hispid on the angles becoming round and glabrous towards the base. Leaves simple, up to 4.5 by 1.5 inches, usually 2-3 by .75-1.25 inches, ovate, oblong or lanceolate, base truncate or sub-cordate, apex acute, dark-green and glabrous above, glaucescent and hispid on the nerves beneath, entire, lateral nerves prominent, 6-10 pairs; petioles up to 1.3 inches long, winged, wing oblanceolate, up to .3 inch wide; stipules .5 inch long, .2 inch wide, erect, persistent. Flowers in lax axillary and terminal racemes 6 inches long.

Pedicels short, bracts lanceolate, cuspidate, costate, .2 inch long. Calyx hispid, .15 inch long; teeth narrow, exceeding the tube. Corolla .25 inch long. Pod 1 by .2 inch, upper suture straight, lower slightly indented between the seeds, joints .1 inch broad, both sutures hispid, faces of the joints glabrous, pod prominently beaked with the persistent base of the style. Seeds 6-8.

Sub-Himalayan tract from the Kangra District eastwards. Flowers: July—September.

11. *Desmodium gangeticum*, DC. *Prodr.* II (1825) p. 327.—A suberect undershrub 3-4 feet high, twigs woody, pubescent. Leaves 1-foliate, very variable in size, up to 5 by 3 inches, orbicular, ovate, rarely elliptic-oblong or lanceolate, base rounded or subcordate, usually gradually narrowed in the upper portion, entire, glabrescent above, glaucescent beneath and clothed with fine adpressed silky hairs; petioles up to 1 inch long; stipules linear, acuminate, striate, erect, persistent; stipels setaceous, up to .2 inch long. Racemes long, slender, arching, terminal and axillary up to 1 foot long. Pedicels .15 inch long, bracts minute. Calyx less than .1 inch long, hairy; teeth deltoid, as long as the tube. Corolla .15 inch long, purple or white. Pod .5-1 by .1 inch, falcate, upper suture slightly, lower deeply indented between the seeds, joints .1 inch long, clothed with minute hooked hairs. Seeds 6-8.

From 5,000 feet in the Himalaya to the Sub-Himalayan tract and in favorable places here and there in the plains, *e.g.*, Changa Manga and Phillaur Plantations. Flowers at various seasons according to locality. Var. *maculatum*, Baker (sp. DC. l.c., p. 327) is supposed to differ in being dwarf and having the leaves roundish-cordate 1 inch or less in length. These characters are not sufficient to separate the small round-leaved forms even as a variety. Such leaves are found on tall vigorous specimens when the branches have been injured or have not died back, and the dwarf specimens would probably grow up into the normal large leaved form if they were able to do so. The dwarf form is found in dry grassy places and the more vigorous larger leaved form in shady undergrowth.

12. *Desmodium latifolium*, DC. *Prodr.* II (1825) p. 327.—An erect undershrub 4-6 feet high, twigs woody, clothed with dense brown pubescence. Leaves 1-foliate, up to 6 by 5 inches, broadly ovate, base cordate or truncate, margin repand, hispid above, clothed beneath with short spreading hairs; petiole up to 1 inch long, densely pubescent, channelled above; stipules deltoid, cuspidate, persistent; stipels setaceous, .1 inch long. Racemes rather dense, ascending, axillary and terminal, up to 8 inches long, densely brown-hairy. Pedicels less than .1 inch long, bracts minute. Calyx .05 inch long, densely hairy; teeth linear, as long as the tube. Corolla purple, .25 inch long. Pod .5-.7 by .1 inch, straight, upper suture slightly, lower deeply

indented between the seeds, joints .1 inch long, densely clothed with hooked hairs. Seeds 4-6.

Sub-Himalayan tract from Kangra District eastwards (Fide Lace, Kangra Working Plan, I have seen no Punjab specimens). Flowers : September.

In addition to the more or less woody species above described the following is very common :—

DESMODIUM GYRANS, DC. *Prodr.* II (1825) p. 326.—An erect shrub-like herb 2-4 feet high. Leaves 1-3-foliolate. Terminal leaflet oblong-lanceolate, obtuse, glabrous above, more or less silky beneath. 3-4 by 1-1.5 inches, lateral leaflets when present, much smaller, less than 1 inch long. Flowers in lax terminal and axillary racemes often paniced. Bracts large, ovate, concealing the flower-buds. Flowers pink, .3 inch long. Pod 1.2-1.5 by .2-.25 inch, upper suture curved not indented, lower suture (along which the pods dehisce) slightly indented, joints 5-10, inconspicuous, broader than long, glabrescent.

Sub-Himalayan tract from the Ravi eastwards and at low elevations in the Himalaya. The *Telegraph* or *Semaphore Plant* so called because the leaflets, especially the lateral ones, when exposed to sunlight exhibit spontaneous jerky movements.

DESMODIUM CEPHALOTES, Wall.—A shrub with 3-foliolate leaves and very grey-silky acutely angled twigs is cultivated in Lahore. It is wild in the United Provinces.

19. *ABRUS*, Linn.

(From the Greek *habros*, soft; referring to the softness of the leaves. **DISTRIB.** Species 6; cosmopolitan in the Tropics.)

ABRUS PRECATORIUS, Linn. *Syst. Nat. ed.* 12. (1767) p. 472.—A woody climber with slender glabrous or sparsely silky branches. Leaves 2-4 inches long, paripinnate; rachis thickened at the base, more or less hairy and channelled in the lower portion, produced beyond the last pair of leaflets as a soft bristle; stipules .15 inch long, linear-subulate. Leaflets 10-20 pairs, opposite, increasing slightly in size from the base, .8-.9 by .15-.25 inch, oblong, very deciduous, thinly membranous, entire, rounded at both ends, minutely apiculate, glabrous above when mature, thinly adpressed silky beneath; petiolules minute. Flowers .4 inch long, pink or white with a pink tinge, in dense axillary pedunculate racemes shorter than or equalling the leaves; peduncles often leaf-bearing, thickened in fruit; pedicels very short, clustered on tubercles on the rachis. Calyx .1 inch long, campanulate, thinly silky, truncate, teeth very short. Standard ovate, narrowed into a short broad claw which is more or less adnate to the staminal tube; wings linear-falcate, shorter than the keel, keel curved. Vexillary stamen absent, the other 9 united into a tube slit above; anthers uniform. Ovary sub-sessile; style short, incurved; stigma small, capitate. Pod 1-1.7 by .4-.5 inch, oblong, turgid, thinly septate between the seeds, thinly pubescent, truncate, with a sharp deflexed beak. Seeds 3-5, ovoid, .3 inch long, scarlet with a black spot at the hilum, polished,

sometimes white with a black spot or uniformly black or white. *Crab's eye*.

Sub-Himalayan tract from the Ravi eastwards; common in hedges, &c. The seeds are used as weights by jewellers (*Rati*) and for necklaces and rosaries (whence the specific name). They are very poisonous and frequently play a part in crime in India. Flowers: August–September, the seeds ripening in the cold season.

20. *MUCUNA*, Adans.

(From *Mucuna-guaca*, the Brazilian name for one of the species.)

Wide-climbing, rarely erect shrubs or herbs, leaves trifoliate with stipels, stipules deciduous. Flowers usually purple, usually in axillary racemes. Calyx campanulate, teeth unequal, the two upper completely united, the lowest often longer than the rest. Standard with infolded auricles at the base, shorter than the keel which usually slightly exceeds the wings, keel incurved and usually beaked. Stamens diadelphous, the upper free, alternately longer with basifixed anthers and shorter with versatile anthers. Ovary sessile; ovules few. Pod variable, usually clothed with irritating bristles, septate or cellular between the seeds. **DISTRIB.** Species about 30; Tropics of both hemispheres.

- A woody climber; pod transversely plaited ... 1. *M. imbricata*.
A slender climber; pod not plaited ... 2. *M. pruriens*.

1. *MUCUNA IMBRICATA*, DC. *Prodr.* II (1825) p. 406.—A large woody climber, branchlets slender, sparsely adpressed hairy, hollow. Leaves trifoliate; petioles 3-6 inches long, sometimes longer, swollen and twisted at the base; stipules linear, .3 inch long. Leaflets about 6 by 4 inches, elliptic, caudate-acuminate, thin, membranous, sparsely adpressed hairy above and below, lateral leaflets oblique, broader than the terminal, petiolules of the lateral leaflets .2-.3 inch long; stipels .15 inch long, setaceous. Racemes sometimes from the old wood, usually axillary on very long slender pendulous peduncles, up to 18 inches long or more. Pedicels .5 inch long, clustered in threes on the tumid nodes of the rachis, each cluster in bud supported by large roundish imbricating concave deciduous bracts. Calyx .7-1 inch long, velvety and with a few long irritating bristles; teeth nearly as long as the tube. Corolla dull-purple; standard 1.5 inches long, 1 inch broad; keel 2.2-5 inches long, abruptly incurved at the apex, pointed; wings .5 inch broad, as long as the keel. Pod oblong, 4-6 by 2 inches, the faces covered with close oblique plaits and with two wings running along each suture, the wings being .5 inch broad, densely clothed with deciduous irritating rusty bristles. Seeds usually 3-4, mottled with black.

Sub-Himalayan tract from the Sulej eastwards ascending to 4,000 feet. Occurs near Jhakri in Bashahr but is rare. Flowers during the rains, very conspicuous, but with a curious faint offensive smell. The leaflets on sterile shoots are often lobed, the terminal with a lobe on either side and the lateral with one lobe on the broader side.

2. *MUCUNA PRURIENS*, DC. *Prodr.* II (1825) p. 405.—A slender wide-spreading climber, woody below, branchlets pubescent. Leaves trifoliate; petiole 2-4 inches long, sometimes longer, swollen and twisted at the base, densely hairy; stipules linear, .2 inch long. Leaflets 3-5 by 2-3 inches, the terminal smaller than the laterals, rhomboid-ovate, cuspidate, adpressed hairy above and densely silvery or grey silky beneath, lateral leaflets very oblique; petiolules of the lateral leaflets .1 inch long; stipels setaceous, .1 inch long. Flowers in axillary racemes sometimes 12 inches long, sometimes reduced to a solitary flower; pedicels 1-3 together; rachis silky; bracts .5 inch long, lanceolate, caducous; pedicels .1-.2 inch long. Calyx .3 inch long, silky, with a few irritating bristles; teeth as long as or longer than the tube. Corolla purple; standard .6 inch long, .5 inch wide; keel 1-1.5 inches long, slightly incurved; wings nearly as long as the keel. Pod 2-2.5 inches long, not winged or plaited, turgid, curved upwards at the tip, densely clothed with rusty persistent irritating bristles. The *Cowitch*. Vern. *Gugli*.

Sub-Himalayan tract from the Ravi eastwards; common in hedges. Flowers during the cold season. *Cowitch* is a corruption of the native name *kivach*. The bristles are used as a vermifuge, being taken mixed up in syrup.

21. *ERYTHRINA*, Linn.

(From the Greek *erythros*, red; referring to the color of the flowers.)

Trees, shrubs or undershrubs, with stout often prickly twigs. Leaves trifoliate, stipules small, stipels glanduliform. Flowers large, usually scarlet, in axillary or terminal racemes, less often axillary, pedicels usually fascicled. Calyx oblique at the mouth and splitting to the base or campanulate and truncate or bilabiate. Standard large; wings short, minute or wanting; keel longer or shorter than the wings, much shorter than the standard. Upper stamen free or connate half way up; anthers uniform. Ovary stipitate; ovules many; style incurved; stigma small, terminal. Pod stalked, narrowed at both ends, compressed or cylindric, turgid, contracted between the seeds, 2-valved or dehiscing like a follicle along the upper suture. **DISTRIB.** Species about 30; tropical and sub-tropical regions of both hemispheres.

ERYTHRINA SUBEROSA, Roxb. *Hort. Beng.* (1814) p. 58.—A medium-sized tree, 40-50 feet high, bark corky, deeply cracked; branches armed with yellowish-white prickles .1-.25 inch long,

which fall off after the third year. Leaves trifoliate, sometimes armed with a few scattered prickles; petiole 4-8 inches long; stipules linear-lanceolate, caducous. Leaflets 4-6 inches long and broad (sometimes broader than long), the terminal rhomboid-ovate, the lateral oblique, usually pointed, base broad, deltoid, margin sinuate, pale green and more or less glabrous above, densely downy with matted pubescence beneath; petiolules of the lateral leaflets .2-.5 inch long; stipules glanduliform, persistent. Racemes 1-4, near the ends of the branches, peduncled, 2-4 inches long; pedicels .5 inch long, in fascicles of 1-3, slender; bracts caducous; bracteoles minute, subulate. Calyx .25-.35 inch long, more or less pubescent, soon becoming bilabiate. Corolla scarlet; standard 1.5-2 by .5-.6 inch; keel-petals less than half as long as the standard, connate, much exceeding the minute falcate pointed wings. Pod stalked, 5-6 inches long, subterete, torulose. Seeds 2-5, pale-brown, dull.

Sub-Himalayan tract from the Ravi eastwards ascending to 3,000 feet. Less common between the Ravi and Indus. Flowers when leafless or with the young leaves. March, April. Frequently planted in hedges by villagers as it grows very readily from cuttings. The wood is light soft and not durable but fibrous and tough and is used for making scabbards and sieve-frames.

There is a form of this tree or more probably a distinct species which is commonly grown in gardens. It has a nearly smooth reddish bark and less hairy leaves. The standard is 1.6-2 by .8-1 inch; the pod is somewhat flattened and the seeds are dark-red and polished. In the plains it reaches 50-60 feet by 5-6 feet girth. It is apparently *E. suberosa*, var. *glabrescens*, Prain in Journ. As. Soc. Beng., LXVI, 2, p. 410, which occurs in the Sub-Himalayan tract and low valleys in the hills, ascending to 7,000 feet in Bashahr but is usually found at about 3,000 feet.

ERYTHRINA BLAKEI, Hort.—A large shrub or small tree with thick crooked bole and massive spreading branches, bark grey, smooth, prickles very few. Leaflets orbicular or ovate, acuminate, 3-4 inches long, glabrous. Flowers in terminal racemes, leafy below with distant flowers, densely flowered above, naked portion about 12 inches long. Calyx campanulate, .4-.5 inch long, slightly 2-lipped, glabrous. Corolla dark-scarlet, 2 inches long, standard .8 inch broad, keel less than half the length of the standard, wings narrow-oblong as long as the keel or nearly so. Pod not produced.

Cultivated in gardens all over Northern India under the above name. Apparently a hybrid or form of *E. herbacea*, Linn. an American species.

22. BUTEA, Roxb.

(In honor of John, Earl of Bute, a botanical author and patron of botany in the 18th century. DISTRIB. Species 3; Tropical Asia.)

BUTEA FRONDOSA, Kœnig, ex Roxb. *As. Res.* III (1792) p. 469.—A small or medium-sized deciduous tree with crooked trunk and large irregular branches; bark fibrous, light-brown or sometimes bluish-grey; young parts tomentose or downy. Leaves pinnately trifoliate; petiole 4-9 inches long, swollen at the base; stipules small, linear-lanceolate, deciduous. Leaflets, the terminal 5-8 by 4.5-7 inches, broadly obovate from a cuneate

base or rhomboid, obtuse or retuse; the lateral obliquely ovate, obtuse, usually slightly smaller than the terminal; all coriaceous, glabrescent above, finely silky and conspicuously reticulate beneath; petiolules 2-3 inch long, stout; stipels sub late. Flowers 1.5-2 inches long, bright-red, tinged with orange, appearing when the tree is nearly leafless, in rigid axillary and terminal racemes 4-7 inches long; pedicels .5-1 inch long, fascicled on the tumid nodes of the stout rachis; bracts and bracteoles small, deciduous. Rachis, pedicels, bracts, bracteoles and calyx outside dark-brown velvety. Calyx .5 inch long, broadly campanulate, grey-silky inside; teeth short, deltoid, the two upper connate. Corolla clothed outside with silvery silky hairs; standard ovate, acute, 1 inch broad, recurved; wings falcate, adhering to the keel; keel much curved, beaked, equalling the standard. Stamens diadelphous; anthers uniform. Ovary shortly stipitate; ovules 2; style elongate, incurved, beardless; stigma terminal, minute. Pods 4-8 by 1-2 inches, thin, flat, grey-silky, reticulate, sutures thickened, with one seed at the apex, narrowed abruptly at the base into a stalk .5-.7 inch long, dehiscent round the seed, indehiscent below. Vern. *Dhák, chichra, paláh, palás*.

Sub-Himalayan tract ascending to 4,000 feet and in the plains except the arid region. Frequently gregarious on soils liable to be waterlogged during the rains and on banks and islands of the Jhelum. The leaves are largely lopped for fodder for buffaloes though they are not eaten by goats hence the proverb "*Unt se ák hakri se dhák*" [Camels shun the *ák* (*Calotropis procera*) and goats the *dhák* (*Butea frondosa*)]. The leaves are much used for plates and for wrapping up parcels. The flowers yield an orange dye and the bark on being wounded exudes a ruby-colored gum-kino, known as *Bengal kino* and used medicinally. The *dhák* is one of the most important host plants for the lac insect, the quantity of lac produced being greater though the quality is not so good as from some other trees. The wood is dirty-white, porous and soft, it is not durable except under water. It is used for well curbs and scoops for wells. *Dhák* seedlings exhibit the phenomenon known as "dying back" in a marked degree. The seedling produces a bulb-like swelling at the top of the root close below the ground and even when grown in flower pots and watered regularly, dies back to the swelling at the commencement of the hot weather, a fresh shoot breaking out from the swollen portion, this process being repeated for several years. Dying back is common with many plants in the United and Central Provinces but does not appear to be at all general in the Punjab. It is doubtless a provision of nature to enable seedlings to pass through the first few hot weathers and with many plants occurs only in dry places but with the *dhák* it seems to be independent of the supply of moisture available. The *dhák* will stand more salt in the soil than most plants. Well-grown specimens in full flower are very handsome but the tree is not ornamental for the rest of the year. Flowers March - April.

23. PUERARIA, DC.

(In honor of M. N. Puerari, a Professor of botany at Copenhagen in the 18th century. DISTRIB. Species 12; Tropical Asia, Japan, New Guinea.)

PUERARIA TUBEROSA, DC. Prodr. II (1825) p. 240.—A deciduous twining shrub, with very large tuberous roots, young

shoots grey-pubescent. Leaves pinnately 3-foliate; petiole 4-8 inches long, grey-tomentose; stipules .2 inch long, ovate-oblong, cordate. Leaflets, the terminal 6-12 inches long and nearly as broad, broadly ovate from a cuneate base; the lateral very oblique; all acuminate, silky when young, glabrescent above, adpressed grey-silky beneath when mature, margins sinuate, 3-nerved at the base or the lateral 4-nerved; petiolules .2-.5 inch long; stipels .1 inch long, linear, acute. Flowers .4-.7 inch long, bright-blue, in lax, simple or paniculate, axillary or terminal racemes 6-12 inches long; pedicels about .1 inch long, fascicled along the grey-pubescent or tomentose rachis; bracts and bracteoles very small, silky. Calyx .2-.3 inch long, very silky; teeth shorter than the tube, oblong, ciliate, subobtuse, the two upper connate. Standard as broad as long with inflexed auricles at the base; wings oblong-falcate, obtuse, united by their bases to the keel; keel obtuse, nearly straight. Stamens monadelphous; anthers uniform. Ovary sessile; ovules many; style filiform, inflexed, glabrous; stigma small, capitate. Pods 2-3 inches long, flat, constricted between the seeds, densely clothed with silky-bristly brown hairs. Seeds 3-6.

Sub-Himalayan tract from the Ravi eastwards, ascending to 4,000 feet in the Himalaya. Fairly common in the Kangra scrub forests. Flowers: March—April. The tubers which are sometimes 18 inches by 12 inches are eaten and given to *tonga*-ponies. They are also used medicinally.

24. **ATYLOSIA**, Wight & Arn. (*Cantharospermum*, W & A in Engl. u. Prantl, Pflanzenfamilien).

(From the Greek *a*, without, and *tulos*, a callosity; referring to the absence of the swollen nodes of the raceme found in many genera.)

Herbs or slender shrubs, erect or climbing. Leaves trifoliate, stipulate but often ex-stipellate, gland-dotted beneath. Flowers yellow, in axillary racemes or clustered in the leaf-axils. Calyx campanulate, teeth distinct, the lowest the longest the two upper more or less united. Corolla exserted; standard orbicular with inflexed auricles at the base; keel obtuse. Stamens diadelphous; anthers uniform. Ovary sessile, 3-many-ovuled; style incurved, glabrous; stigma small, capitate. Pod straight, compressed, 2-valved, septate between the seeds and marked without by transverse grooves. Seeds with a conspicuously divided strophiole. **DISTRIB.** Species about 25; Tropical Asia, Australia, Mauritius and Madagascar.

Flowers racemose; petals marcescent;
leaflets stipellate ... 1. *A. mollis*.

Flowers clustered; petals deciduous;
leaflets exstipellate ... 2. *A. scarabaeoides*.

1. *ATYLOSIA MOLLIS*, Benth. *Pl. Jungh.* (1851-55) p. 243.—A wide-spreading slender climbing shrub, twigs woody striate densely brown-tomentose. Petiole 1-2 inches long, densely brown-tomentose; stipules minute, ovate, caducous. Leaflets rhomboid, 1-2·5 by 1-2 inches, very minutely pubescent above but densely brown pubescent on the nerves as well as on the whole lower surface so that the yellowish resinous glands are obscure, rather thick, entire, 3-nerved at the base, the lateral very oblique, 3-4-nerved; petiolules ·05-·1 inch long, stalk of the terminal leaflet ·1-·2 inch long; stipels subulate, densely hairy. Flowers in axillary racemes 1-3 inches long, shortly peduncled; pedicels ·3 inch long, geminate; bracts ·5 inch long, broad-ovate, many-nerved and gland-dotted concealing the flower-buds, caducous. Calyx ·3 inch long, pubescent, glandular, lowest tooth lanceolate equalling the tube, the others shorter and broader. Corolla yellow, ·8 inch long, marcescent. Pod 1-2 by ·35 inch, straight, yellow-glandular and brown-tomentose, externally furrowed between the seeds. Seeds 6-9. *A. crassa*, Prain.

Sub-Himalayan tract from the Rawalpindi District eastwards ascending to 6,000 feet. Flowers in the cold season. Common in Kangra District.

Atylosia crassa, Prain, is a form of this plant with the leaflets rather thick and prominently reticulate beneath, the terminal leaflet is as broad as long or nearly so. In the typical *A. mollis*, Benth., as understood by Prain the leaflets are thinner and less prominently veined and the terminal leaflet is usually distinctly longer than broad. The other characters mentioned by Prain, Journ. As. Soc. Beng. LXVI, 2, p. 421, I find to be valueless. As both forms occur in the same localities and appear to be identical in habit no advantage is gained by endeavoring to separate them.

2. *ATYLOSIA SCARABÆOIDES*, Benth. *Pl. Jungh.* (1851-55) p. 243.—A small climber sometimes with a short woody basal portion and slender wiry densely grey-pubescent stems. Petiole ·5-1·5 inches long, densely pubescent; stipules minute, deltoid. Leaflets ·7-1·7 by ·5-1 inch, elliptic or elliptic-obovate, clothed on both sides but especially below with dense short grey pubescence, glandular dots minute, usually very inconspicuous, rather thick, entire, 3-nerved; the lateral leaflets oblique; petiolules very short, stalk of the terminal leaflet hardly ·1 inch long; stipels 0. Flowers 2-6 on short axillary peduncels; pedicels ·2 inch long. Calyx ·25 inch long, densely grey-pubescent; teeth linear, the lowest twice as long as the tube. Corolla yellow, ·3-·4 inch long, deciduous. Pod ·7-1 by ·35 inch, straight, furrowed between the seeds, densely clothed with short grey or brownish pubescence and long silky spreading hairs. Seeds 4-6.

Sub-Himalayan tract from the Hoshiarpur District eastwards, ascending to 6,000 feet. Flowers most of the year.

25. *RYNCHOSIA*, Lour.

(From the Greek *rhunchos*, a beak; referring to the keel.)

Twining or prostrate herbs or undershrubs, rarely erect shrubs. Leaves pinnately (rarely digitately) 3-foliolate, stipules ovate or lanceolate. Leaflets dotted beneath with resinous glands; exstipellate. Flowers usually yellow, in axillary racemes, solitary or in pairs along the rachis, rarely solitary in the leaf-axils; bracts caducous, bracteoles 0. Calyx campanulate, the two upper teeth more or less connate. Corolla included or exserted, standard obovate or orbicular with inflexed auricles at the base; wings narrow; keel incurved at the tip. Stamens diadelphous; anthers uniform. Ovary sessile; ovules 2 very rarely 1; style long, filiform, much incurved; stigma small, capitate. Pod rounded or oblong, compressed or turgid, usually continuous (rarely septate) within. Seeds 2 (rarely 1) strophiole conspicuous, rarely wanting. **DISTRIB.** Species about 100; Tropics of both hemispheres, a few in N. America and S. Africa.

An erect shrub ... 1. *R. Pseudo-cajan*.

A twining undershrub ... 2. *R. sericea*.

1. *RYNCHOSIA PSEUDO-CAJAN*, *Camb. in Jacq. Voy. Bot.* (1844) p. 45, t. 55.—An erect evergreen shrub, branches striate, grey-tomentose. Leaves pinnately 3-foliolate; petiole .5-1.5 inches long; stipules minute. Leaflets, the terminal 1.3 by .6-1.8 inches, from rhomboid-ovate-lanceolate to suborbicular; the lateral smaller, oblique; all rather thick, margins entire or sinuate, minutely pubescent above, grey-tomentose beneath and closely dotted with small yellow glands, apex usually deltoid, nerves prominent beneath, 3 basal with an additional much smaller pair; petiolules up to .1 inch long. Flowers .5 inch long, yellow, in dense axillary racemes 1-3 inches long; pedicels .1-.2 inch long; bracts .15 inch long, linear. Rachis, pedicels, bracts on the back and calyx outside, densely grey-tomentose and dotted with yellow glands. Calyx .3 inch long; teeth narrow, acuminate, the lowest linear-setaceous, exceeding the tube, the others lanceolate, equalling the tube. Standard grey-pubescent on the back. Pod 1 by .3-.4 inch, straight, hard, grey-tomentose, dehiscent, with 1-2 seeds in the upper part. Seeds estrophiolate.

Himalaya ascending to 9,000 feet from the Indus eastwards. Common on open grassy hill-sides and in the undergrowth of Chil forests. Flowers: May—June, sometimes at other seasons.

2. *RYNCHOSIA SERICEA*, *Spanoghe, in Linnæa* XV (1841) p. 195.—Stems woody, slender, wide-twining, clothed with soft,

spreading, grey, glandular hairs, Leaves pinnately 3-foliate, petiole 2-4 inches long, glandular-hairy; stipules .4-.5 inch long, oblong, acute. Leaflets, the terminal 2-3 inches long and broad, rhomboid or suborbicular; the lateral very oblique; all abruptly short-acuminate, pubescent on both surfaces, sparsely dotted with yellow glands beneath, margins sinuate, 3-nerved; petioles .1 inch long; stipels sometimes present, minute. Flowers .7 inch long, dark-red, in lax, axillary, pedunculate racemes 8-12 inches long, bracts linear, much exceeding the minute pedicels. Calyx .3 inch long, pubescent and dotted with glands; the two upper teeth connate with free tips; the lower linear acuminate, exceeding the tube. Standard hairy and glandular on the back. Pod 1-1.2 by .3 inch, turgid, pubescent, 2-seeded, tipped with the long persistent base of the style, slightly recurved. Seeds estrophiolate.

Himalaya ascending to 7,000 feet and Sub-Himalayan tract, Chamba, Kulu, Bashahr, Simla, Hoshiarpur. Common in grassy blanks. Flowers: July—September.

26. **FLEMINGIA**, Roxb. (*Moghania*, St. Hil. in Pflanzenfamilien.

(In honor of Dr. J. Fleming of the Bengal Army.)

Erect, prostrate, rarely twining herbs, undershrubs or shrubs. Leaves simple or digitately trifoliate, dotted beneath with resinous glands which are sometimes very obscure, stipulate, stipels 0. Flowers in racemose clusters, each cluster hidden by a large folded bract or in racemes which are paniculate or contracted and capitate. Calyx-tube short; teeth narrow, subequal or the lowest the longest. Corolla slightly or not exerted; standard with infolded auricles at the base; wings usually adhering to the keel, straight or incurved, obtuse or acute. Stamens diadelphous; anthers uniform. Ovary sessile or subsessile, 2-ovuled; stigma small, capitate. Pod small, oblique, turgid, 2-valved, continuous within. Seeds estrophiolate. **DISTRIB.** Species about 30; tropics of the Old World.

Leaves simple 1. *F. fruticulosa*.

Leaves trifoliate.

A shrub, racemes about as long as the leaves 2. *F. semialata*.

An undershrub, racemes about as long as the
petioles 3. *F. prostrata*.

1. **FLEMINGIA FRUTICULOSA**, Wall. Cat. (1828) No. 5754.—A low trailing undershrub, twigs striate, densely brown- or grey-tomentose, woody towards the base. Leaves simple, 1-4 inches long, suborbicular, elliptic or ovate, base cordate, apex blunt, entire, glabrescent above, paler beneath and hairy on the nerves and gland-dotted, 3-nerved at the base, sometimes with an additional 1-2 pairs less strongly developed; lateral

nerves 3-5 pairs; petiole .1-.2 inch long, stout, hairy; stipules .1-.4 inch long, lanceolate, erect, persistent, striate. Racemes 3-6 inches long, terminal; rachis zigzag, densely hairy. Flowers in small clusters hidden by large folded reniform membranous bracts, arranged distichously; bracts strongly nerved, broader than long, up to 1 by 1.25 inches, slightly emarginate, shortly petioled with erect persistent stipules. Calyx .25 inch long, brown-silky; teeth linear, acute, exceeding the tube. Corolla white, slightly exceeding the calyx. Pod .3 inch long, turgid, pubescent. *F. strobilifera*, var. *fruticulosa*, Baker in Fl. Brit. Ind. II, p. 227. Collett, Fl. Siml. fig. 41.

Himalaya from the Indus eastwards ascending to 9,000 feet. Common in grassy forest undergrowth and blanks. Flowers: August-October. Also Trans-Indus.

2. *FLEMINGIA SEMIALATA*, Roxb. Hort. Beng. (1814) p. 56.—An erect shrub, twigs angular, densely grey-hairy. Leaves digitately trifoliate; petiole 1-3 inches long, narrowly winged; stipules amplexicaul, linear, .5 inch long, caducous. Leaflets up to 6 by 2 inches, narrowed from the middle to a small rounded base and upwards to an acuminate tip, thin, membranous, entire, hairy on the nerves on both sides, minutely gland-dotted on the lower surface, 3-nerved; the lateral leaflets oblique, 4-nerved; petiolules .2 inch long. Flowers in axillary and terminal often branched racemes about equalling the leaves. Bracts ovate, densely grey-silky, caducous. Calyx .4 inch long, densely grey-silky; teeth much exceeding the tube. Corolla purple, equalling the calyx. Pod .5 inch long, turgid, with a thin downy easily detachable outer covering. Seeds 2, black, shining. *F. congesta*, var. *semialata*, Baker in Fl. Brit. Ind. II, p. 229.

Himalaya ascending to 5,000 feet. Sub-Himalayan tract from Rawalpindi District eastwards, fairly common. Flowers: August-September. The glands on the leaves are often very obscure.

3. *FLEMINGIA PROSTRATA*, Roxb. f. ex Roxb. Hort. Beng. (1814) p. 56.—An undershrub with very short stem and annual woody triquetrous twigs densely grey-hairy when young. Leaves digitately trifoliate; petiole 1-2 inches long, narrowly winged; stipules .2-.6 inch long, erect, linear, persistent, almost meeting behind the stem. Leaflets very variable in size, 1.5-9 by .5-2 inches, usually about 3 by 1 inch, narrowed from below the middle to both ends, entire, rather thick, densely hairy on the midrib and minutely hairy on the blade above, more or less pubescent beneath and gland-dotted; petiolules .1 inch long, stout. Flowers in congested axillary racemes about as long as the petioles. Bracts ovate, densely brown-silky, caducous. Calyx .25 inch long, densely clothed with spreading grey-silky

hairs. Corolla equalling the calyx. Pod .4 inch long, turgid, downy. *F. congesta*, var. *semialata*, Baker, Fl. Brit. Ind., II, p. 229.

Sub-Himalayan tract and Himalaya ascending to 5,000 feet, from the Simla District eastwards. Rare in the Punjab, has only been collected once by Drummond on "Hills near the Giri."

27. DALBERGIA, Linn. f.

(In honor of Nicholas Dalberg, a Swedish botanist who died in 1820. DISTRIB. Species 60-70; tropical regions of the world.)

DALBERGIA Sissoo, Roxb. *Hort. Beng.* (1814) p. 53.—A deciduous tree, bark rough, furrows mainly longitudinal, young parts downy or tomentose. Leaves imparipinnate, rachis 1.5-3 inches long, somewhat zig-zag, swollen at the base; stipules .2 inch long, lanceolate, caducous. Leaflets 3-5, alternate, 1.5-2.5 inches long, broadly ovate or suborbicular, conspicuously and abruptly acuminate, glabrescent, firm, entire, base truncate broadly rounded or cuneatè; petiolules .1-.2 inch long, rather stout; stipels 0. Flowers .2-.3 inch long, pale yellowish-white, sessile or nearly so, in axillary panicles shorter than the leaves, composed of several short subsecund spikes; rachis and branches hairy; bracts small, caducous, ciliate. Calyx .2 inch long, tubular-campanulate; teeth short, ciliate, the two upper connate, the lowest the longest subacute, the rest obtuse, all shorter than the tube. Standard ovate; wings oblong; keel obtuse, its petals joined at the tips, nearly straight. Stamens 9, united into a tube slit along the upper side; anthers minute, uniform, basifixed. Ovary pubescent; style shorter than the ovary, thick, glabrous; stigma capitate; ovules 2-4. Pod 1.5-4 by .3-.5 inch, thin, strap-shaped, glabrous, slightly reticulate. Seeds 1-4, flattened. The *Sissoo*. Vern. *Shisham*, *tālī*.

Indigenous to the Sub-Himalayan tract ascending in the Outer Himalaya to 4,000 feet. Gregarious on islands and banks of rivers subject to flooding and sometimes found in patches in dry scrub forests where a bed of clay brings the sub-soil water to the surface. Planted everywhere in the plains along roadsides, canals and on the edges of fields and frequently self-sown or spreading naturally by root-suckers. The heartwood is brown mottled with darker veins, hard, heavy and durable. It is much in demand for furniture, wheels, boats, carts, etc. The *Sissoo* has been more planted in the Punjab than any other tree, the best known plantation being at Changa Manga of 9,605 acres, irrigated during the hot weather from the Upper Bari Doab Canal. After much time had been lost in experiments it was ascertained that the best method of growing *Sissoo* in irrigated plantations is to make trenches 1 foot by 1 foot at 10 feet intervals, the earth from the trenches being placed on one side of the trench and the *Sissoo* seed being sown in the loose earth slightly above the natural level of the ground. The seed is watered by percolation from the trenches and must be kept moist till it germinates. The water in the trenches must not be allowed to rise too high as the young seedlings will not stand flooding and if the soil gets flooded over the seed it is apt to cake and cause the seed to rot. Practically the whole area of Changa Manga has been stocked under this method.

A serious fungus disease has caused much damage to shisham of recent years in Changa Manga. It is caused by *Fomes lucidus* (Leys), Fr., which attacks the roots of living trees and speedily causes their death. Large trees, coppice shoots and seedlings are attacked indiscriminately. The same disease is apparently killing Sissoo shade trees in tea-gardens round Delhra Dun. Nothing has been done to arrest the spread of the disease nor is it likely that any practical measures can be taken but it will probably be necessary to find a tree to replace the Sissoo in Changa Manga or at least to mix with it. The leaves fall about January-February, fresh foliage appearing in March and the flowers in March to May.

DALBERGIA LATIFOLIA, Roxb. The Blackwood.—A tree much resembling the Sissoo but with smoother stem, longer leaf-rachises, obtuse leaflets, pedicellate flowers and broader pods. Planted occasionally in gardens. It has been tried in Changa Manga but without success probably owing to frost to which it is rather sensitive.

DALBERGIA LANCEOLARIA, Linn.—A large tree not unlike *Albizia procera* in appearance. Leaflets 11-17, elliptic, 1-2 inches long. Flowers 2-4 inch long, dull-white in large lax terminal and axillary panicles. Brandis, Ind. Trees, fig. 101.

Indigenous east of the Ganges and from Rajputana southwards. Cultivated in Lahore. An ornamental tree but the timber is poor. Flowers: July.

28. PONGAMIA, Vent.

(From the Tamil name, *pongam*. **DISTRIB.** Species 1; Tropical Asia and Australia.)

PONGAMIA GLABRA, Vent. Jard. Malm. (1803) p. 28.—A medium-sized tree, almost evergreen, bole usually short, crown spreading shady, bark smooth grey, twigs glabrous. Leaves imparipinnate, rachis 2-6 inches long, swollen at the base; stipules small, oblong, obtuse, caducous. Leaflets 5-9, opposite, 2-4 inches long, ovate-oblong or elliptic, usually shortly abruptly acuminate, glabrous, bright green and rather glossy above, veins prominent beneath; petiolules 2-3 inch long; stipels 0. Flowers 5 inch long, white tinged with violet or pinkish, in pedunculate axillary racemes shorter than the leaves; rachis glabrous or puberulous; pedicels 3-4 inch long, very slender, fasciated on the tumid nodes of the rachis; bracts ovate, acute, 1 inch long, caducous. Calyx 15 inch long, campanulate, purplish, brown-pubescent outside, mouth truncate, obscurely toothed. Standard suborbicular, emarginate, very shortly clawed; wings obliquely oblong, slightly adhering to the keel; keel obtuse, straight, its petals cohering at the tips. Stamens monadelphous, the vexillary stamen free at the base; anthers uniform, versatile. Ovary sessile, finely pubescent; ovules 2; style filiform, incurved; stigma small, terminal. Pod 1.5-2 by .7-1 inch, woody, obliquely oblong, indehiscent. Seeds usually 1.

Along the foot of the Himalaya extending west to the Ravi; not common. Often planted in gardens in the plains as far west as Rawalpindi and occasionally in the Sub-Himalayan tract. The wood is fairly hard, white turning yellow on exposure but not durable. The seeds give a thick reddish-brown oil used

for burning and medicinally for skin diseases. The tree is handsome and shady, easily grown from seeds or cuttings. Flowers: April—May.

29. SOPHORA, Linn.

(From *sophero*, the Arabic name of some papilionaceous tree.)

Trees or shrubs, rarely perennial herbs. Leaves imparipinnate. Flowers showy, in terminal racemes or panicles; bracts and bracteoles minute or 0. Calyx-teeth short. Corolla much exserted; standard broadly obovate or orbicular, usually shorter than the keel; wings oblong, oblique; keel oblong, obtuse, nearly straight. Stamens free, rarely connate at the base into a ring; anthers uniform, versatile. Ovary shortly stipitate; ovules many; style incurved; stigma minute, terminal. Pod moniliform, round or slightly compressed, fleshy, leathery or woody, usually indehiscent; joints turgid. Seeds obovoid or globose, estrophiolate. **DISTRIB.** Species about 25; warmer regions of both hemispheres.

Mature leaflets sparsely downy; pedicels in flower usually longer than the calyx; mature pod glabrous ... 1. *S. mollis*.

Mature leaflets silky-velvety beneath; pedicels in flower usually shorter than the calyx; pod persistently silky ... 2. *S. Griffithii*.

1. *SOPHORA MOLLIS*, *Grab. in Wall. Cat.* (1828) No. 5335.—An erect deciduous shrub 3-4 feet high, young shoots finely grey-pubescent or downy. Leaves 5-10 inches long; stipules very small, triangular, acute, caducous. Leaflets 21-35, opposite or alternate, .5-1 inch long, ovate or elliptic, obtuse, often emarginate, entire, more or less sparsely downy on both sides. Flowers nearly 1 inch long, bright-yellow, appearing shortly before the leaves, in short axillary racemes 2-4 inches long; pedicels .3-.4 inch long, bracts nearly .1 inch long, thick, concave. Calyx .25 inch long, oblique, finely grey-downy. Standard longer than the keel. Filaments free, hairy at the base. Ovary densely hairy. Pod 3-5 inches long; joints 5-10, 1-seeded, more or less distinctly constricted between the seeds, 4-winged, glabrous when mature. Seeds .25 inch long, ovoid, dark-brown, dull.

Himalaya ascending to 6,000 feet and Sub-Himalayan tract Trans-Indus to Nepal. Locally common, *e.g.*, near Malkandi, Kagan and Kilba, Bashahr. Usually on open hot slopes. Flowers: March—April.

2. *SOPHORA GRIFFITHII*, *Stocks, in Hook. Kew Journ. Bot.* IV (1852) p. 147.—A small erect deciduous shrub, twigs densely hoary. Leaves 4-8 inches long; stipules minute, villous, persistent often after the fall of the rachis. Leaflets 21-41, opposite or alternate, .25-.5 inch long, ovate or obovate, thick, rigid, glabrous above when mature, densely adpressed silvery-velvety beneath. Flowers .7 inch long, yellow, appearing with the

young leaves in pedunculate racemes 1·5-5 inches long, peduncle usually leaf-bearing, pedicels in flower ·1-·2 inch long. Calyx ·2 inch long, very oblique, densely grey-silky outside. Ovary villous. Pod persistently silky, the joints with 4 longitudinal ridges. Otherwise as for *S. mollis*.

Salt Range and hills Trans-Indus.

SOPHORA TOMENTOSA, Linn. An erect evergreen shrub. Leaflets 15-19, 1-2 inches long, broadly elliptic, obtuse, thinly grey-downy above and densely so beneath. Flowers nearly 1 inch long, pale-yellow, in terminal erect racemes.

Cosmopolitan in the tropics on the sea-coasts. Cultivated in gardens in Lahore, &c. Flowers in the cold season and is apt to be damaged by frost.

SOPHORA SECUNDIFLORA, DC.—An evergreen shrub or small tree. Leaves 5-6 inches long, glabrous. Leaflet usually 9, 1·5-2 inches long, obovate, emarginate, strongly reticulate on both sides. Flowers ·8 inch long, pale violet-blue, in dense terminal drooping racemes 4-6 inches long. Pod 1-7 inches long, ·5 inch wide, joints rounded, covered with dense hoary tomentum. Seeds bright scarlet.

Indigenous to the Southern United States and North Mexico. Cultivated in gardens in the plains. A very free flowering and ornamental plant but of slow growth. Flowers fragrant, in March.

SOPHORA JAPONICA, Linn.—A tree up to 45 feet in height. Leaflets 7-17. Flowers yellowish-white. A hardy tree indigenous to China. Has long been grown in Lahore but does badly. It would probably do well in the hills.

The following plants of the sub-family *Papilionata* not belonging to Indian genera are cultivated :—

AMORPHA FRUTICOSA, Linn.—A deciduous shrub. Leaves imparipinnate up to 12 inches long. Leaflets 11-25, opposite, pellucid-punctate, up to 1·6 by ·7 inch. Flowers dark-purple, in terminal racemes 6 inches long. Calyx ·1 inch long, teeth unequal, the upper shorter. Corolla twice as long as the calyx, the standard alone present. Stamens 10, monadelphous, anthers uniform. Ovary sessile; ovules 2. Pod ·3-4 inch long, glandular, curved upwards at the tip. *The Bastard Indigo*.

Native of the United States from Iowa to Florida. Cultivated in Saharanpur, Lahore, Abbottabad, &c. Flowers: April. It thrives in moist places on river banks, etc.

ULEX EUROPEUS, Linn.—A small shrub. Leaves (trifoliate in seedlings) reduced to spiny phyllodes ·3-4 inch long, branches reduced to subulate thorns resembling the phyllodes, furrowed, the longer ones about 1 inch long. Flowers yellow, solitary or in pairs. Calyx divided to the base into 2 lips ·5 inch long. Corolla ·6-7 inch long. Stamens 10, monadelphous, anthers uniform. Ovary sessile. Pod ·6 inch long, turgid, hairy. *The Gorse*.

Native of Western Europe. Cultivated in Simla, &c. It dislikes a lime soil. Like so many xerophytic plants the Gorse grows well in the plains up to the rains but dies immediately the monsoon starts.

CYTISUS LABURNUM, Linn.—A small deciduous tree. Leaves trifoliate, petiole ·8-2·5 inches long. Leaflets elliptic-lanceolate or obovate, about 2·5 by 1 inch, pale beneath. Flowers yellow, in pendulous racemes up to 15 inches long. Calyx ·2 inch long, 2-lipped. Corolla ·8 inch long. Stamens 10, monadelphous, anthers uniform. Ovary stipitate. Pod 3 by ·3 inch, with thickened more or less winged sutures. Seeds poisonous, as also all other portions of the tree. *The Laburnum*.

Native of the mountains of Europe. Cultivated in all the hill stations and at Abbottabad.

CYTISUS SCOPARIUS, *Link.*—A small shrub, twigs angular, almost winged, green. Leaves rather scanty, mostly shortly petioled, trifoliate. Leaflets about 5 inch long, lanceolate or oblanceolate. Flowers yellow, axillary or paired. Calyx 1 inch long, glabrous, 2-lipped. Corolla 8 inch long. Stamens monadelphous, four nearly twice as long as the other six. Ovary sessile; style curled round, swollen below the stigma. Pod flat, 1.5 by .4 inch, continuous within. *The Broom.*

Native of Europe. Cultivated in Simla, Narkanda, Bashahr, etc. Likes sandy slopes and open forest undergrowth and does not avoid limestone. *Var. Andreanus* is also grown, it has a brown mark on the standard and is very ornamental.

SPARTIUM JUNCEUM, *Linn.*—A tall shrub, twigs round, greyish-green. Leaves simple, scanty or almost wanting, linear-lanceolate, thick, up to 1 inch long. Flowers yellow, in loose terminal racemes. Calyx spatheaceous, split down one side, .3 inch long. Corolla 1 inch long. Stamens 10, monadelphous, anthers uniform. Ovary sessile, hairy; style glabrous, curved; stigma, decurrent on the inner side of the style. Pod 3.4 by .3 inch. *The Spanish Broom.*

Native of the Mediterranean and Canary Islands. Cultivated in Simla, Bashahr and Abbottabad and flowers profusely. It can be grown in the plain and flowers in April in Lahore.

WISTERIA SINENSIS, *DC.*—A large deciduous woody climber. Leaves imparipinnate, about 12 inches long. Leaflets 7-11, elliptic-lanceolate, 2.5-3 by .8-1.2 inches, acute or acuminate, thin, membranous, shortly petiolulate. Flowers blue, fragrant, in pendulous racemes 8-12 inches long. Calyx .2 inch long, hairy, teeth unequal, the lowest the longest. Corolla 1 inch long, standard with small pockets above the claw. Stamens 10, diadelphous; anthers uniform. Ovary stipitate, hairy, with a lobed disk at the base of the stipe. Pod 4 inches long, widest near the top, with thick woody valves, brown and velvety without, mealy within.

A native of China. Cultivated in the hills and plains. Flowers profusely in Abbottabad and ripens its fruits, in the plains and at high elevations in the hills it does not flower well.

CAJANUS INDICUS, *Spreng.* An erect shrub 5-10 feet high, branches sulcate, silky. Leaves trifoliate. Leaflets .5-3 inches long, oblong-lanceolate, acute at both ends, entire, minutely pubescent above, densely silky-pubescent beneath, dotted with inconspicuous yellow glands. Flowers .7 inch long, yellow or veined with red, in axillary pedunculate racemes, longer than the leaves, panicle towards the ends of the branches. Calyx .25-.3 inch long, pubescent and glandular, viscid. Corolla three times as long as the calyx, petals equal in length, keel truncate. Stamens diadelphous, anthers uniform. Ovary subsessile; ovules few; style long, filiform, much upcurved; stigma capitate. Pod 2-3 inches long, brown-tomentose, with oblique depressions between the seeds, tipped with the persistent base of the style. Seeds the size of a small pea, yellow, red, brown or black. *Pigeon Pea. Vern. arhar, tor.*

Probably indigenous to Tropical Africa, cultivated as a rainy season crop. The seeds are used for *ddl* or ground into flour.

CASTANOSPERMUM AUSTRALE, *A. Cunn.*—A large evergreen tree. Leaves 1-1.5 feet long; leaflets 11-15, ovate-elliptic or broadly oblong, glabrous, 3-5 inches long. Flowers 1 inch long, yellow, orange or red, in racemes, usually from the old wood. Stamens 10, all free. Pod 8-9 by 2 inches, containing 3-5 large chestnut-like seeds. *The Moreton Bay Chestnut.*

Indigenous to Queensland and N. S. Wales. Occasionally cultivated in the plains. Flowers: May.

Sub-family II—CÆSALPINIOIDÆ.

Trees or shrubs, rarely herbs. Leaves simple, trifoliate, pinnate or bipinnate, usually stipulate. Leaflets usually exstipellate. Flowers variable in size and color, irregular, rarely regular, usually bisexual, in axillary, lateral or paniced racemes, rarely cymose or spicate. Calyx 5-merous or by the fusion of the two upper lobes 4-merous, divided to the top of the disk which lines the calyx-tube, very rarely gamosepalous, sepals imbricate, rarely valvate. Petals 5, rarely fewer or 0, the upper innermost in bud, the others variously imbricate. Stamens 10 or fewer, very rarely indefinite; filaments usually free, more or less unequal. Ovary free, sessile or on a stipe which is more or less fused to the disk or calyx-tube.

TRIBE IX.—EUCÆSALPINIÆ.—Leaves bipinnate. (In *Parkinsonia* apt to be taken for pinnate.)

Pinnæ 6-10 pairs, distant ... 30. *Cæsalpinia*.

Pinnæ 1-3 pairs, crowded ... 31. *Parkinsonia*.

TRIBE X.—CASSIÆ.—Leaves simply pinnate ... 32. *Cassia*.

TRIBE XI.—BAUHINIÆ.—Leaves simple, mostly deeply 2-lobed at the apex ... 33. *Bauhinia*.

30. CÆSALPINIA, Linn.

(In honor of Andreas Cæsalpini, professor of medicine at Pisa in the 16th century. He was the first botanist to classify plants by the flowers and fruits.)

Trees or climbing shrubs, armed or not. Leaves bipinnate, stipules various. Flowers yellow or red, often showy, in loose, axillary or terminal racemes or panicles. Calyx-tube short, lobes 5, imbricate, the lowest concave and usually larger than the rest. Petals 5, clawed, orbicular, rarely oblong, spreading, imbricate, subequal or the upper smaller. Stamens 10, free, declinate; filaments often villous or glandular at the base. Ovary sessile or subsessile; ovules few; style filiform, sometimes clavate at the top; stigma terminal, truncate or concave. Pod oblong or ligulate, dehiscent or not, smooth or prickly. DISTRIB. Species 40; tropics of both hemispheres.

Stipels prickly; pedicels 2 inch long; pod prickly ... 1. *C. Bonducella*.

Stipels not prickly; pedicels 5-1 inch long; pod smooth ... 2. *C. sepiaria*.

1. CÆSALPINIA BONDUCELLA, *Fleming, in Asiat. Res.* XI (1810) p. 159.—A large scandent or scrambling shrub, branches

downy, armed with straight prickles. Leaves 12-18 inches long, rachis with 1-2 recurved prickles at the base of each pinna and scattered straight or recurved prickles between the pinnæ; pinnæ 6-8 pairs, opposite, 2-6 inches long; stipules cut into large segments. Leaflets 6-10 pairs on each pinna, opposite, .7-1.5 inches long, elliptic-oblong, obtuse, mucronate, more or less puberulous especially beneath; petiolules minute; stipels represented by short hooked prickles. Flowers yellow, .4-.6 inch long, in supra-axillary and terminal, pedunculate racemes, 6-12 inches long, lax below, dense towards the top; pedicels very short in bud, .2 inch long in flower, brown-tomentose as are also the bracts and rachis; bracts .4-.5 inch long, linear, acute, exceeding the buds. Calyx .2-.3 inch long, lobes obtuse, brown-tomentose within and without. Petals .4-.6 inch long, oblanceolate, the upper smaller and sometimes spotted with red. Filaments flattened and silky-hairy in the lower half. Pod 2-3 by 1.5-2 inches, shortly stalked, densely covered with wiry prickles. Seeds 1-2, lead-colored, shining, .5-.7 inch long. Brandis, Ind. Trees, fig. 108. *The Fever-nut.*

Indigenous to the Sundriban, Burma and the Andamans. Cultivated and self-sown in the Sub-Himalayan tract as far west as the Ravi, also cultivated in the Salt Range and occasionally in the plains. The seeds are used in native medicine as a tonic and febrifuge. The plant is also cultivated as a hedge plant. Flowers: July—September.

2. *CÆSALPINIA SEPIARIA*, *Roxb. Hort. Beng.* (1814) p. 32.—A large scandent or scrambling shrub, branches downy, armed with hooked or straight prickles. Leaves 9-15 inches long, rachis armed with recurved prickles at the junction of and between the pinnæ; pinnæ 5-10 pairs, opposite, 2-4 inches long; stipules semisagitate, caducous. Leaflets 8-12 pairs, opposite, .6-.8 by .2-.4 inch, oblong, very obtuse at both ends, usually glabrous above, pale, glaucous and minutely puberulous beneath; petiolules minute; stipels 0. Flowers .5-.7 inch long, yellow, in simple terminal and axillary racemes about 12 inches long; pedicels .5-1 inch long, hairy, jointed near the flower; bracts .2 inch long, ovate-lanceolate, tomentose, caducous. Calyx .4-.5 inch long, lobes oblong, pubescent on both sides, yellowish. Petals suborbicular, the lower .5 inch across, the rest 3 inch across. Filaments woolly in the lower half. Pod 2.5-4 by .8-1.1 inches, sessile, beaked, narrowly winged along the ventral suture, somewhat woody and turgid, late in dehiscing. Seeds 4-8, ovoid, .4 inch long, compressed, smooth, mottled brown and black. Brandis, Ind. Trees, fig. 110. Vern. *Relan*, *kanderi* (Ku.), *uri* (Haz.).

Sub-Himalayan tract and Outer Himalaya ascending to 5,000 feet from the Indus eastwards. Fairly common in ravines and hedges. Flowers:

March—April. Sometimes cultivated in hedges for which it is excellent but requires a lot of room.

CESALPINIA PULCHERRIMA, Swartz.—A glabrous erect shrub almost or quite unarmed. Leaves 4-6 inches long. Flowers 1·5 inches across, yellow or red. Filaments very long, bright-red. Pod 2·3 by ·7 inch, sub-sessile, smooth, flattened, dehiscent. *Poinciana pulcherrima*, Linn. Grown occasionally in gardens. Probably a native of America.

CESALPINIA CORIARIA, Willd.—*The American Sumach* or *Divi-divi*. A small tree. The sinuous pods yield a large quantity of tannin. There is a specimen in Lahore but it does badly and suffers from frost. Flowers: September.

CESALPINIA GILLIESII, Wall. — A deciduous shrub, young shoots pubescent and glandular. Leaves 10 inches long, 5 inches wide, bipinnate. Pinnæ about 10 pairs and an odd one. Leaflets ·3 by ·1 inch, oblong, glabrous, glaucous beneath with glandular dots near the margin. Flowers 2 inches across, yellow, in terminal racemes; pedicels 1 inch long, glandular. Stamens very much exerted, about 4 inches long, crimson.

Indigenous to South America. Cultivated in Lahore. Flowers: April—October. A very hardy plant, it can be grown out of doors in England.

31. *PARKINSONIA*, Linn.

(In honor of John Parkinson, 1567-1629, an apothecary of London and botanical author. *DISTRIB.* Species 3, two in North America and one at the Cape.)

PARKINSONIA ACULEATA, Linn. *Sp. Pl.* (1753) p. 375.—A small evergreen tree, bark thin, smooth, branches green, glabrous, armed with sharp stout spines ·3-·5 inch long, formed from the indurated rachises of the leaves on vigorous shoots: Leaves distant on vigorous shoots with usually 2 pairs of pinnæ congested at the base of the rachis, crowded on dwarf axillary shoots, with 1 pair of pinnæ on a minute spinescent rachis. Pinnæ 6-12 inches long, their rachises winged, flattened, nearly ·1 inch wide. Leaflets 25-30 pairs, minute to ·2 inch long, oblong-obovate or obovate, minutely petiolulate. Flowers ·7-1 inch across, yellow, in lax axillary racemes 5-6 inches long; pedicels ·4-·5 inch long, slender, spreading, jointed near the flower. Calyx ·3 inch long, cleft nearly to the base, segments 5, oblong, deciduous. Petals 5, ·5-·7 inch long, broadly obovate or suborbicular, veined, with short stout villous claws. Stamens 10, free; filaments flattened, villous at the base. Ovary shortly stipitate, silky-villous; ovules many; style filiform, glabrous; stigma minute, terminal. Pod 1-4 inches long, moniliform, slender, attenuated at both ends, thin, longitudinally veined. Seeds 1-6, oblong, nearly terete, smooth, mottled light and darker brown.

Indigenous to the Southern United States and Northern Mexico where it is known as the *Retama* or *Horse Bean*. Cultivated in the plains of the Punjab but west of the Jhelum it suffers from frost. Naturalized here and there on sandy soil, e.g., near Ludhiana. Reaches 20-30 feet in height and 1 foot in diameter at the base. The heartwood is scanty, purplish-brown, hard and heavy, sapwood white or yellowish. The tree is rapid in growth and might be useful for afforesting sandy soils. It stands drought well, but is not found self-sown in arid places. Often cultivated for its showy flowers which appear in April and May.

32. CASSIA, Linn.

(The classical name of some tree with aromatic bark).

Trees, shrubs or herbs. Leaves paripinnate, a gland on the rachis between the leaflets or on the petiole below them; stipules various. Flowers yellow, less often red or white, in axillary or terminal racemes or panicles or 1-3 axillary. Calyx deeply divided, lobes 5, imbricate. Petals 5, imbricate, subequal or the lowest the largest. Stamens usually 10, all fertile and equal or the upper shorter, or the 3 upper very short, rudimentary or wanting or stamens 5 only; anthers equal or those of the 1 or 3 lower stamens larger, usually dehiscing by terminal pores or short slits. Ovary sessile or stipitate; ovules many; style short or long; stigma terminal. Pod variable, terete or flat, dehiscent or not, septate or continuous, sometimes mealy within. Seeds placed transversely (rarely longitudinally), horizontally or vertically compressed, albuminous. **DISTRIB.** Species about 380; throughout the tropics, mainly in America, a few extra tropical.

A tree, pod terete ... 1. *C. Fistula*.

A shrub or undershrub, pod flattened ... 2. *C. occidentalis*.

1. **CASSIA FISTULA**, Linn. *Sp. Pl.* (1753) p. 377.—A small or medium-sized nearly evergreen tree, bark pale-grey, smooth up to middle age, twigs pubescent when young. Leaves 9-18 inches long, rachis terete, pubescent; stipules minute, linear-oblong, pubescent. Leaflets 4-8 pairs, opposite, 2-6 by 1·5-3 inches, ovate or ovate-oblong, usually acute or somewhat acuminate, glossy-green and glabrous above, paler and silvery-pubescent beneath when young, lateral nerves numerous, prominent beneath; petiolules 2-3 inch long. Flowers 2 inches across, yellow, in lax drooping axillary racemes 12-24 inches long; pedicels 1-2 inches long, slender, spreading; bracts 15 inch long, linear, tomentose; bracteoles 1 inch long, ovate, acute, tomentose; both caducous. Calyx 3-4 inch long, divided almost to the base; segments oblong, obtuse. Petals 7-1 inch long, obovate, shortly clawed, subequal, veined. Stamens all antheriferous, the three lowest the longest with very long curved filaments and oblong anthers dehiscing longitudinally, the 4 or 6 lateral with short straight filaments and versatile anthers opening by pores at the base, the 1 or 3 upper the smallest with indehiscent anthers. Ovary stipitate; style short, incurved. Pod 1-2 feet long, 1 inch diameter, cylindric, smooth, pendulous, dark brownish-black when ripe, seeds 40-100 immersed in a dark-colored, sweetish pulp, and separated from one another by transverse septa. Seeds about 4 inch dia-

meter flattened. *The Indian Laburnum, Purging Fistula.* Vern. *Amaltás, kariár.*

Sub-Himalayan tract ascending to 4,000 feet in the Outer Himalaya from the Indus eastwards. Frequently cultivated in the plains. Heartwood rather small, yellowish-red or brick-red, darkening on exposure, very hard, rather brittle and apt to splinter but very durable and useful for posts, etc. The tree as usually seen is rather small about 2-3 feet in girth with a short crooked bole and consequently it yields timber only of small dimensions used locally by villagers. The leaves are not eaten by cattle or goats and seedlings are often seen springing up on village grazing grounds. The pulp of the fruits is used as a purgative and the fruits are collected and exported from Kangra for this purpose. The bark is used for tanning. Very showy when in flower about April-June, being at this time almost bare of leaves.

2. *CASSIA OCCIDENTALIS*, Linn. *Sp. Pl.* (1753) p. 377.—An undershrub reaching 6 feet in height with a stem as thick as the wrist, but often an annual. Leaves 6-8 inches long, petiole with a solitary stipitate gland near the base; stipules .4 inch long, semicordate, acuminate, caducous. Leaflets 3-5 pairs, opposite, 1-3.5 by .5-1.3 inches, lanceolate or ovate-lanceolate, tapering to an acute tip, rounded at the base, membranous, glabrous on both sides, paler beneath, very foetid when bruised; petiolules very short. Flowers about .5 inch across, yellow, in shortly peduncled, axillary, corymbose racemes forming a terminal panicle; pedicels in flower .2 inch long; bracts .3-.4 inch long, ovate, oblique, acuminate, glabrous, caducous, white tinged with pink. Calyx .4 inch long, divided almost to the base; segments glabrous, oblong, obtuse, white tinged with pink. Petals .5 inch long, oblong-obovate, subequal, obtuse, faintly veined with orange. Stamens, the 3 upper reduced to staminodes, the 3 lower longer and with larger anthers than the 4 lateral. Pod 4-5 inches long, .3 inch wide and .2 inch thick, slightly falcate, compressed, transversely septate, distinctly torulose. Seeds 20-30, ovoid, compressed, .25 inch long by .2 inch wide, rounded at the top, subacute at the base, smooth, hard, shining, pale-brown.

Sub-Himalayan tract and in the moister parts of the plains from the Ravi eastwards. Probably introduced from Tropical America. Common on waste ground, roadsides and forest blanks. The seeds in Africa and Mauritius are roasted, ground up and used as a substitute for coffee. The leaves, roots and seeds are used medicinally. Sometimes called the *Coffee Senna* or *Negro Coffee*. Flowers during the rains.

The following species are cultivated occasionally in gardens and deserve to be more widely grown:—

CASSIA SIAMEA, Lamk.—A fairly large tree of rapid growth. Leaflets 6-14 pairs, 1.5-2 inches long, elliptic-oblong, glaucous beneath. Flowers .5-.7 inch across, bright-yellow, in large terminal panicles. Stamens 7 perfect. Pod 4-10 by .4-.5 inch, flat, thickened at the sutures, firm.

Indigenous to South India, Siam, etc. Cultivated in the East Punjab and fairly hardy. The wood is handsome and likely to be useful for furniture.

CASSIA GLAUCA, *Lamk.*—A shrub or small tree. Leaves 6-9 inches long, rachis with conspicuous stipitate glands between the lowest pair or pairs of leaflets. Leaflets 4-10 pairs, 1-3 inches long, elliptic, glaucous beneath. Flowers 1.5 inches across, canary-yellow, in axillary corymbose racemes. Stamens all (10) perfect. Pod 4-8 by .6 inch, thin, flat, with raised lines between the seeds.

Indigenous to parts of India and Australia. Cultivated in Lahore, the tree being covered with masses of flower in the autumn and flowering again less profusely about May.

The genus contains several herbaceous plants, one of which *Cassia obtusifolia*, *Linn.*, is abundant as a weed along roadsides in the Kangra District, springing up in immense quantities during the rains. The plant is a native of Tropical America. It has 3 pairs of obovate-oblong leaflets with a conical gland between the lowest pair. Stamens 7 perfect. Pod 8-10 by .2 inch, subterete, obliquely septate.

33. BAUHINIA, *Linn.*

(In honor of John and Caspar Bauhin, German botanists of the 16th century.)

Trees or shrubs, erect or climbing by tendrils. Leaves usually simple, more or less deeply cleft at the apex, rarely entire or divided into two leaflets; stipules various, caducous. Flowers white, rarely pink, red or purple, in terminal and axillary racemes or in a large terminal panicle, usually bisexual. Calyx-tube short, turbinate or campanulate or long and tubular, lined with the disk to the top, limb entire and spathaceous or cleft into 2-5 valvate, rarely imbricate, lobes. Petals 5, sub-equal, erect or spreading, imbricate, the upper innermost. Stamens 10, all fertile or 1-9 of them reduced to staminodes or wanting; filaments free, filiform; anthers versatile, dehiscing longitudinally. Ovary stipitate, rarely sessile, the stipe usually adnate to the upper side of the calyx-tube; ovules 2-many; style long or short; stigma small or large and peltate, subterminal or oblique. Pod linear or oblong, continuous or mealy within, dehiscent or not. Seeds albuminous. **DISTRIB.** Species about 150; tropics of both hemispheres.

Trees.

Fertile stamens 10; pod indehiscent.

Leaves not acid; calyx spathaceous; pod
rigid, falcate ... 1. *B. racemosa*.

Leaves acid; calyx 5-cleft, pod flexible,
straight ... 2. *B. malabarica*.

Fertile stamens 3-5; pod dehiscent.

Leaves entire or notched at the apex ... 3. *B. retusa*.

Leaves deeply cleft.

Leaves cleft half-way down; calyx-tube
shorter than the limb ... 4. *B. purpurea*.

Leaves cleft one-third of the way down;
calyx-tube longer than the limb ... 5. *B. variegata*.

A climber ... 6. *B. Vahlhii*.

1. *BAUHINIA RACEMOSA*, Lamk. *Encycl. Method.* I (1783) p. 390.—A small deciduous tree with short bole and spreading crown, bark dark-brown, rough with deep vertical cracks, young twigs pubescent. Leaves .8-2 by 1-3 inches, broader than long, cleft less than half-way down into two rounded lobes, glabrous above, paler and pubescent beneath, base usually cordate, 7-9-nerved; petiole .3-.7 inch long. Flowers .5 inch long, white, in terminal or leaf-opposed, pubescent racemes 3-5 inches long, pedicels .2-.4 inch long; pubescent, jointed near the middle; bracts minute, linear, acute. Calyx .3 inch long, pubescent, tube turbinate, limb 2-3 times the length of the tube, spathaceous, ultimately reflexed. Petals narrow oblanceolate, acute. Stamens 10, all fertile; filaments densely hairy at the base. Ovary pubescent; stigma sessile. Pod 5-10 by .7-1 inch, stipitate, turgid, rigid, falcate. Seeds 12-20, oblong, compressed, black, .3 inch long. Vern. *Jhinjera* (Simla).

Sub-Himalayan tract from the Ravi eastwards; not common. The inner bark gives a fibre used for ropes. Flowers: March—June; fruit ripens in the cold season but remains long on the tree.

2. *BAUHINIA MALABARICA*, Roxb. *Hort. Beng.* (1814) p. 31.—A medium-sized tree, bark dark-brown, exfoliating in long strips, young twigs pubescent or tomentose. Leaves 1.5-5 by 1.7-6 inches, broader than long, cleft about one-fourth the way down into two rounded lobes, glabrous above, pale glaucous and more or less pubescent beneath, base cordate, 7-11-, usually 9-nerved; petiole .8-1.2 inches long, pubescent, thickened at both ends, channelled. Flowers .5 inch long, white, in small terminal paniculate racemes 1.5-3 inches long; pedicels .5-1 inch long, slender, grey-tomentose, jointed below the calyx; bracts minute, ovate, acute. Calyx .3-.5 inch long, grey-tomentose, tube narrow-turbinate, limb divided into 5 linear subacute segments slightly longer than the tube. Petals oblong, spatulate, little exerted. Stamens 10, all fertile, alternately long and short. Ovary pubescent; style produced. Pod 7-12 by .7-1 inch, on a stalk 1 inch long, nearly straight, somewhat turgid, flat, flexible, marked when dry with raised wavy lines descending obliquely from the middle to the edges of the valves. Seeds 20-30, ovoid-globose, .2 inch long, dark-brown, polished. Brandis, Ind. Trees, fig. 113.

Sub-Himalayan tract from the Ravi eastwards. Wood light reddish-brown, coarse-grained, not used. The leaves have a characteristic acid taste. Flowers: August—October. Fruit: January—May. According to Haines and Brandis this tree is evergreen but according to Kanjilal and Gamble deciduous. I have never seen it leafless.

3. *BAUHINIA RETUSA*, Roxb. *Hort. Beng.* (1814) p. 31.—A moderate-sized tree, bark dark-brown with a few vertical fissures,

young shoots glabrous or nearly so. Leaves 3-6 inches long, slightly broader than long, entire or notched at the tip, cordate or truncate at the base, subcoriaceous, glabrous, 9-11-nerved; petiole 1.5-3.5 inches long, thickened at both ends. Flowers .7 inch across, white, in lax large terminal panicles, the lower branches of which are axillary; pedicels .6-.8 inch long, silky-pubescent; bracts .1 inch long, linear; bracteoles similar to but smaller than the bracts, close below the flower. Calyx .2-.3 inch long, silky-pubescent, split almost to the base into 2-3 segments. Petals twice as long as the calyx, long-clawed, obovate, hairy outside, the three upper mottled with purple. Stamens 3 perfect. Ovary hairy on the edges, stipitate, the stipe adnate to the calyx-tube; style produced. Pod 4-7 by 1.2-1.5 inches, shortly stipitate, oblong or oblanceolate, flat, firm, late in dehiscing, red until ripe. Seeds 6-8, flat, suborbicular, dark-brown, smooth.

Sub-Himalayan tract and Outer Himalaya ascending to 4,000 feet from the Indus eastwards. Occurs in the Jowlian Reserve, Khanpur Range, Hazara, but has not been collected between this and the Beas. The wood is the best of the *Bauhinias*: it is red and hard but not used. In the United Provinces the tree is much tapped for gum. It is found usually near water. Flowers: September—November. Fruit: February—March. According to Haines this tree is evergreen but according to Gamble deciduous. I have not seen it leafless.

4. *BAUHINIA PURPUREA*, *Linn. Sp. Pl.* (1753) p. 375.—A medium-sized deciduous tree, bark ashy to dark-brown, nearly smooth, young parts brown-pubescent. Leaves 3-6 inches long, rather longer than broad, cleft about half-way down into two acute or rounded lobes, very minutely pubescent beneath when young, base usually cordate, 9-11-nerved; petiole 1-1.5 inches long. Flowers large, rosy-purple, in few-flowered terminal, brown-tomentose panicles; pedicels .2-.5 inch long, stout, tomentose; bracts and bracteoles small, tomentose, deltoid. Calyx tomentose, tube .3-.4 inch long, limb twice as long as the tube, usually splitting into 2 reflexed segments, one emarginate, the other 3-toothed. Petals 1.5-2 inches long, oblanceolate, long-clawed, spreading, veined. Stamens usually 3 fertile, the others reduced to antherless filaments. Ovary downy, long-stalked; style long; stigma large, oblique. Pod 6-10 by .6-.8 inch, on a tomentose stipe .6-1 inch long, linear, flat, pointed, greenish tinged with purple till ripe, late in dehiscing. Seeds 12-15, suborbicular, flattened, .5 inch diameter, dark-brown, smooth. Vern. *Khairwál* (Simla).

Sub-Himalayan tract and Outer Himalaya ascending to 4,000 feet from the Indus eastwards. Heartwood pinkish turning brown, hard, durable but little used. The bark is used for dyeing and tanning, and the bast for fibre. Often cultivated in gardens or on roadsides. Flowers: September—November. Fruit: January—March. The flowers vary in color from white to deep rosy-purple.

5. *BAUHINIA VARIEGATA*, Linn. *Sp. Pl.* (1753) p. 375.—A medium-sized deciduous tree, bark dark-brown, nearly smooth, young shoots brown-pubescent. Leaves 4-6 inches long, as broad as or rather broader than long, cleft one-quarter to one-third of the way down into two obtuse lobes, pubescent beneath when young, the pubescence persisting along and in the axils of the nerves, subcoriaceous, base usually deeply cordate, 11-15-nerved; petiole 1-1·5 inches long. Flowers large, fragrant, white or purplish, appearing when the tree is leafless, in short axillary or terminal, few-flowered, grey-pubescent racemes; pedicels short or 0; bracts and bracteoles minute, tomentose, deltoid. Calyx grey-tomentose, tube slender, ·5-1 inch long, limb spathaceous, as long as the tube, 5-toothed at the apex. Petals 2-2·5 inches long, obovate, with long rather broad claws, all white or 4 petals pale-purple and the fifth darker with dark-purple veins. Stamens 5 fertile, no staminodes. Ovary pubescent along the sutures, long-stalked; style long; stigma capitate. Pod 6-12 by ·7-1 inch, hard, flat, dehiscent, on a glabrous stipe 1 inch long. Seeds 10-15. Vern. *Kachnâr, kaliâr, kolâr*.

Sub-Himalayan tract and Outer Himalaya ascending to 4,000 feet from the Indus eastwards. Wood greyish-brown, heartwood irregular. Uses as for *B. purpurea* but the bark is also used medicinally. Often cultivated in gardens. The tree is apt to be mistaken for *B. purpurea* but it has a different season for flowering and fruiting which affords a convenient method of distinguishing between them. Flowers: February—April. Fruits during the rainy season.

6. *BAUHINIA VAHLII*, Wight and Arn. *Prodr.* (1834) p. 297.—A gigantic climber, branchlets often terminating in a pair of revolute tendrils, young parts fulvous or rusty tomentose. Leaves 4-18 inches long and about as broad, cleft one-third of the way down into two rounded lobes, dark-green and glabrescent above when mature, more or less densely tomentose beneath, base deeply-cordate, 11-15-nerved; petiole 3-6 inches long, stout, tomentose. Flowers 1·5-2 inches across, white turning buff as they fade, in long-peduncled terminal corymbose racemes; pedicels 1-2·5 inches long, with two linear bracteoles and deciduous lanceolate bracts at the base, all densely tomentose. Calyx villous with grey fulvous or rusty hairs, tube slender ·2-·3 inch long, limb ·4-·5 inch long, splitting into 2 broadly ovate lobes. Petals ·7-1·7 inches long, obovate, clawed, adpressed silky on the backs, with glabrous crisped margins. Stamens 3 fertile; filaments woolly at the base; staminodes 2-7, small. Ovary densely tomentose, its stipe adnate to the calyx-tube; style long, hairy; stigma capitate. Pod 9-12 by 2-3 inches, flat, woody, shortly stipitate, rusty-velvety, late in dehiscing. Seeds 6-12, suborbicular, 1 inch diameter, flat, dark-brown, polished. Vern. *taur* (Ka).

Sub-Himalayan tract and Outer Himalaya from the Ravi eastwards, ascending to 3,000 feet. Abundant in Kangra in ravines and moist forest undergrowth, and occasionally reaching a girth of 5-6 feet. Known as the *Camel's foot climber* as the leaves are very much the size and shape of a camel's footprint. The leaves are used as plates, for umbrellas and for wrapping up parcels. The bast yields a strong coarse fibre used for rough cordage. The stem is usually much fluted and has a peculiar anomalous structure, consisting of irregularly shaped masses of wood arranged concentrically in a mass of red juicy phloem. It is a climber destructive to forest trees but in the Punjab occurs mainly on steep banks of streams, etc., where the prevention of erosion is of more importance than the growing of timber. When cut it coppices vigorously, the shoots growing 15-20 feet or more in the year so that an area has to be worked over repeatedly to keep it in check. The seeds are roasted and eaten. Flowers: April—June. Fruits in the cold season.

Several members of the genus are occasionally seen in gardens in the plains.

A.—A climber.

BAUHINIA CORYMBOSA, *Roeb.*—An extensive slender climber. Leaves about 1·5 inches long and broad, cleft three-fourths the way down, 5-7-nerved. Flowers white, faintly tinged with pink, in corymbs terminating short lateral branchlets. Stamens 3 fertile with 2-5 staminodes. Style short, stigma large. Pod 4-5 by 7 inch, thin, smooth, dark-brown.

Indigenous to China. Has long been grown in Indian gardens for its ornamental foliage. Flowers: May.

B.—Erect shrubs or trees.

BAUHINIA ACUMINATA, *Linn.*—An erect deciduous shrub 6-10 feet high. Leaves 3-5 inches long, nearly as broad as long, cleft nearly half-way down, lobes acute or subobtusely, glabrous above, finely pubescent beneath, base slightly cordate, 9-11-nerved. Flowers 2·5 inches across, white, appearing with the young leaves in short lateral or terminal racemes; pedicels 5-7 inch long. Calyx 1-1·3 inches long, tube very short, limb spathaceous, narrowed to a long point, cleft at the tip. Stamens 10 fertile. Style 5 inch long. Pod 4-5 by 7 inch, firm, glabrous, with a rib on each side of the upper suture, beaked, stipitate, stipe 5 inch long.

Indigenous to Central India, Ceylon, Malaya and China. Flowers: March—May.

BAUHINIA GALPINI, *N. E. Br.*—An evergreen straggling shrub 5-10 feet high. Leaves 1-1·5 by 1·4-1·8 inches, slightly cleft at the top, lobes rounded, base truncate or very slightly cordate, 7-nerved, glabrous, paler beneath. Flowers 2-2·5 inches across, in short leaf-opposed 6-10-flowered racemes. Calyx-tube about 1 inch long, very slender; limb spathaceous, as long as the tube. Petals crimson or scarlet, claws as long as the limbs. Stamens 3 perfect, the remainder reduced to subulate staminodes. Ovary long-stipitate, pubescent; style 2 inch long. Pod similar to that of *B. acuminata* but 1 inch broad.

Indigenous to the Transvaal and adjacent Tropical Africa. Flowers: September—October.

BAUHINIA HOOKERI, *F. v. M.*—An evergreen spreading tree. Leaves cleft into two distinct leaflets 1-1·5 by 7-1 inch, obliquely elliptic, rounded at both ends, glabrous, pale beneath, finely 5-7-nerved. Flowers 2-3 inches across, white, in short, many-flowered, terminal racemes. Calyx-tube about 7 inch long, tomentose, limb 5 inch long, lobes 5, oblong. Petals 1-1·5 inches long, villous outside. Stamens 10 fertile. Ovary on a long stipe; style 7 inch long.

Indigenous to Queensland and North Australia. Has long been grown in Saharanpur. The form grown is var. *puberula* of the *Flora Australiensis*. Flowers : May.

The following plants belonging to the sub-family *Cæsalpinioideæ* are cultivated :—

GLEDITSCHIA MACRACANTHA, *Desf.*—A large deciduous tree with large tufts of branched thorns on the stem and larger branches. Leaves paripinnate (on seedlings and vigorous shoots bipinnate), rachis 4-7 inches long. Leaflets about 7-9 pairs, opposite or alternate, 1-2 inches long, oblong, very oblique at the base, denticulate. Flowers 2 inch long, polygamous, greenish, in raceme-like panicles 4-9 inches long which appear from naked buds on shoots of the previous year or terminate short leafy shoots. Calyx minutely pubescent, tube 1 inch long, lobes 15 inch long, ovate. Petals equalling the calyx-lobes, oblong, obtuse, minutely pubescent within and without. Stamens 10, filaments dilated and hairy at the base; anthers versatile. Ovary rudimentary and villous in male flowers, hairy on the sutures in bisexual flowers. Pod up to 12 by 2 inches, flat, coriaceous, subsessile, seeds 3 inch long, flat, quadrate, embedded in pulp.

Indigenous to China. Cultivated in gardens in the plains where it does well and is hardy.

GLEDITSCHIA TRIACANTHOS, *Linn.*—A large erect deciduous tree, armed with tufts of branched thorns on the stem and larger branches. Leaves paripinnate (on seedlings and vigorous shoots bipinnate), rachis 5-7 inches long. Leaflets about 12-15 pairs, opposite or alternate, 7-1 inch long, oblong, crenulate. Flowers 2 inch long, polygamous, greenish, in racemes about 2 inches long, on dwarf leafy shoots. Pod up to 20 by 15 inches on a stipe 5 inch long, curved or straight, flat, seeds elliptic, embedded in pulp. Otherwise as for *G. macracantha*.

Indigenous to the United States. Cultivated in the plains and occasionally in the Sub-Himalayan tract up to 4,000 feet. Does very well in the Punjab and is frost-hardy. It would be an excellent roadside tree except that it is leafless from November to March. Flowers : April.

POINCIANA REGIA, *Bojer.*—A large deciduous tree. Leaves bipinnate, up to 2 feet long with 11-18 pairs of pinnae. Leaflets 3-4 by 1-15 inch, oblong, about 20-30 pairs on each pinna. Flowers 4 inches across, bright-scarlet, in lax terminal and axillary racemes. Calyx-tube short, lobes subequal. Petals orbicular, crisply imbricate, clawed. Stamens 10, free, much exerted. Pod 12 inches or more by 2 inches, compressed, firm, rather thick. Seeds oblong, transverse, mottled.

Cultivated in Delhi and the East Punjab, not hardy in the central portion. The *Gold Mohr*, a native of Madagascar. Flowers in the hot weather.

HÆMATOXYLON CAMPECHIANUM, *Linn.*—A large shrub, leaves 1-3 inches long, leaflets about 4 pairs, 5-1 inch long, broadly obovate, apex obtuse, emarginate. Flowers 5 inch across, yellow, in racemes 2-4 inches long. Pod 15 inches long, 3-4 inch broad, membranous, narrowed at both ends. *Log wood*.

Indigenous to Tropical America. Suffers somewhat from frost in Lahore.

CERCIS SILIQUASTRUM, *Linn.*—A deciduous shrub or small tree. Leaves up to 5 inches diameter, reniform, often broader than long, 7 nerved at the base. Flowers from the old wood, dark-purple. Pod 4 inches long, 7 inch broad, thin, the upper suture narrowly winged. *Judas tree*.

Indigenous to S. Europe. Does well in Abbottabad.

SCHOTIA BRACHYPETALA, *Sond.*—A small evergreen tree somewhat resembling *Ceratonia Siliqua*. Leaves paripinnate. Leaflets 2-4 pairs,

opposite, 1·5-2·5 inches long, oblong or obovate, coriaceous, glabrous. Flowers crimson, in panicles often from the old wood. Calyx about ·6 inch long, 4-partite. Petals minute, hidden within the crimson calyx. Stamens 10, connate at the base, anthers much exserted. Pod about 2 inches long, coriaceous, upper suture winged; seeds few, arillate.

Indigenous to Natal. Has long been grown in Saharanpur and Lahore as *S. latifoli*, Jacq., a plant which differs in the petals being longer than the calyx.

HARDWICKIA BINATA, *Rowl.*—A large tree easily recognized by its leaves with a single pair of very oblique leaflets 1·2 inches long. Brandis, Ind. Trees, fig. 113.

Indigenous to Central India. An ornamental tree but of slow growth. Cultivated occasionally in the plains, but I have never seen it in flower or fruit.

CERATONIA SILIQUA, *Linn.*—A small evergreen dicecious tree. Leaves paripinnate. Leaflets 3-5 pairs, opposite, 1·5-2 inches long, elliptic or broadly obovate, emarginate, dark glossy-green and glabrous above, minutely pubescent beneath. Flowers unisexual, minute, green, in spike-like racemes 2-12 inches long, axillary from the old wood. Calyx small, saucer-shaped, lobes very short. Petals wanting. Stamens 5, filaments long. Disk conspicuous, intra-staminal. Ovary shortly stipitate, arising from the centre of the disk, grey-pubescent; stigma large, capitate, subsessile. Pod 3-8 by ·5-1 inch, curved, compressed, thick and turgid, seeds pale-brown, shining, embedded in pulp. *Carob tree.*

Indigenous to the Eastern Mediterranean Region. Introduced in Saharanpur about 1840 and at one time cultivated by the Forest Department for its edible pods which are also a valuable food for cattle. The tree was tried all over the province in Lahore, Changa Manga, the Salt Range, Nurpur, Kangra and Abbottabad. With sufficient care it can be grown at any of these places though in Abbottabad it suffers from frost in severe winters. The growth is slow and though the fruits are produced in abundance they are rather dry and are not appreciated by cattle. The tree has consequently not been a success and its further cultivation has long since been abandoned by the Forest Department though it is still grown in gardens and is ornamental. The seeds in Europe were formerly used as weights (carat) as are the seeds of *Abrus precatorius* in India. Flowers: October—November.

TAMARINDUS INDICA, *Linn.*—A large evergreen tree. Leaves 3-6 inches long, paripinnate. Leaflets 10-20 pairs, opposite, ·5-·7 by ·15-·2 inch, oblong. Flowers in lax 10-15-flowered racemes terminating short lateral shoots. Calyx-tube turbinate; teeth lanceolate, the two lowest connate. Petals 4-6 inch long, pale-yellow striped with red, the upper hooded, the two lateral ovate, the two lower reduced to scales. Stamens monadelphous, 3 perfect, the others reduced to bristles. Pod 3-8 by ·8-1 inch, slightly compressed, indehiscent. Seeds dark-brown or black, irregularly shaped, embedded in a dark-brown pulp. The *Tamarind*. Vern. *Imli*.

Probably indigenous to Tropical Africa; cultivated in Delhi and the East Punjab; rarely seen and suffers from frost east of the Beas. An excellent shade tree in the south-east of the Province but not worth growing elsewhere.

SARACA INDICA, *Linn.*—A small evergreen tree. Leaves 6-10 inches long, paripinnate; rachis corky at the base; stipules intrapetiolar, completely united. Leaflets 4-6 pairs, 4-8 inches long, oblong-lanceolate, glabrous. Flowers changing from yellow to orange and finally scarlet, in dense corymbs, 3-4 inches across, from nodes of the old wood; bracts and bracteoles colored. Calyx petaloid; tube ·5-·7 inch long, cylindric; segments 4, oblong, subequal, shorter than the tube. Petals 0. Stamens 7-8, much exserted. Ovary

stipitate; style curved into a ring. Pods 6-10 by 2 inches, hard, flat, dehiscent. The *Asoka Tree*.

Indigenous to South India and Burma. Grown in gardens in the Punjab and does well. Flowers: May.

Sub-family III—MIMOSOIDEÆ.

Trees or shrubs, rarely herbs. Leaves pinnate or more often bipinnate. Flowers small, regular, usually 5-merous, in globose heads or cylindric spikes, rarely shortly pedicelled and in slender racemes or globose umbels. Calyx toothed or lobed, rarely divided to the base, lobes or sepals valvate (rarely imbricate). Petals isomerous with the calyx-segments, valvate, free or connate, hypogynous or obscurely perigynous. Stamens as many as or twice as many as the petals or indefinite, free or monadelphous or adnate to the base of the corolla-tube; anthers small, dehiscing longitudinally. Ovary free at the bottom of the calyx.

TRIBE XII—INGEE.—Stamens indefinite, more than ten, monadelphous ... 34. *Albizzia*.

TRIBE XIII—ACACIEÆ.—Stamens indefinite, more than ten, free ... 35. *Acacia*.

TRIBE XIV—EUMIMOSEÆ.—Stamens as many as or twice as many as the petals. Anthers eglandular. Pod flat, not pulpy within.

Pod jointed, when ripe joints separating from the persistent sutures ... 36. *Mimosa*.

Pod not jointed.

A shrub, shoots virgate, ribbed ... 37. *Desmanthus*.

A small tree, shoots terete ... 38. *Leucæna*.

TRIBE XV—ADENANTHEREÆ.—Stamens 10. Anthers gland-crested in the early stage. Pod turgid, pulpy within ... 39. *Prosopis*.

34. ALBIZZIA, Durazz.

(In honor of Albizzi, an Italian naturalist of the 18th century.)

Unarmed trees or shrubs. Leaves bipinnate. Flowers (in the Indian species) in globose heads, sessile or pedicellate, bisexual, usually 5-merous. Calyx tubular or campanulate, toothed or shortly lobed. Corolla funnel-shaped, the petals connate to above the middle. Stamens indefinite, connate at the base only or high up; filaments usually much exceeding the corolla; anthers minute, eglandular. Ovary sessile or shortly stipitate; style filiform; stigma minute, capitate. Pod large, thin, strapshaped, straight, dehiscent or not, continuous and without pulp within. DISTRIB. Species about 50; Tropics of the Old World, a few extra-tropical.

Pinnæ 6-20 pairs; leaflets with the midrib close to the upper edge, acute.

Leaflets scarcely 1 inch broad ... 1. *A. stipulata*.

Leaflets broader .15-.3 inch wide.

Leaflets acute, flowers pink, calyx-teeth distinct ... 2. *A. Julibrissin.*

Leaflets usually obtuse, flowers yellow, calyx-teeth sub-obsolete ... 3. *A. odoratissima.*

Pinnæ 2-6 pairs; leaflets usually with the midrib near the centre, mostly obtuse.

Leaflets not exceeding .5 inch wide; calyx-teeth obsolete ... 3. *A. odoratissima.*

Leaflets broader, at least towards the ends of the pinnæ; calyx-teeth distinct.

Flowers pedicellate, pods pale straw-colored.

A large gland on the rachis .25 inch from its base and glands between each of the terminal pairs of leaflets ... 4. *A. Gamblei.*

Gland on the rachis (when present) usually further from the base, a second often between the uppermost pair of pinnæ, glands on the rachises of the pinnæ (when present) below several of the upper pairs of leaflets ... 5. *A. Lebbek.*

Flowers sessile, pods brown ... 6. *A. procera.*

1. *ALBIZZIA STIPULATA*, Boivin, in *Encyc. du XIX Siècle*, II (1834 ?) p. 33.—A large deciduous tree of rapid growth with a broad flat-topped crown, bark grey nearly smooth, young shoots and inflorescence clothed with grey or yellowish pubescence. Rachis 6-12 inches long, sometimes longer, with a large gland on the petiole about 1 inch from the base and 1 or more between the upper pairs of pinnæ; stipules large, about 1 inch long, obliquely cordate, acuminate, deciduous, in some forms (var. *Smithiana*) small. Pinnæ 6-20 pairs, 2-6 inches long. Leaflets 20-45 pairs, .3-.5 inch long, by about .1 inch wide, linear-oblong, acute, slightly falcate, membranous, pale-green and glabrous above, downy especially on the margin and midrib beneath, midrib very close to the upper edge; petiolules 0. Flowers yellowish-white, in peduncled heads arranged in axillary and terminal panicles; peduncles .7-1.2 inches long; bracts about .5 inch long, ovate, acuminate, deciduous; pedicels .05 inch long. Calyx .1 inch long, tubular, widened upwards, pubescent, teeth short, acute. Corolla .2-.25 inch long, yellowish-white, pubescent outside; lobes lanceolate, acute, half as long as the tube. Stamens 1-1.3 inches long, staminal-tube exceeding the corolla-tube. Pod 4-7 by .5-.7 inch, thin, glabrous, light-brown, minutely punctate, late in dehiscing. Seeds 8-10. Vern. *Ohi* (Ka).

Sub-Himalayan tract and Outer Himalaya ascending to 4,000 feet from the Indus eastwards. Common in the Kangra District where the rainfall exceeds 70-80 inches, regenerates fairly freely and is often cultivated. Growth very rapid, the fastest of the trees indigenous to the Punjab and attains a girth of 12-15 feet but the bole is usually short. Wood soft, sapwood

large and readily attacked by insects, heartwood brown, not durable. Large trees can usually be readily disposed of in Kangra being used for planks. Cultivated in gardens in the plains and grows rapidly, a tree in Saharanpur reached 7 feet in girth in 17 years. As a wild tree outside the Kangra District it is usually met with in low valleys along streams. In the lower Kagan valley it is often seen but only as quite small specimens with the appearance of seedlings a year or two old. Easily recognized in the field by its large stipules. Flowers: April—June.

2. *ALBIZZIA JULIBRISSIN*, *Durazz. in Mag. Tosc.* III, 4 (1772) p. 11.—A medium-sized tree, bark dark-grey, nearly smooth, young shoots and inflorescence clothed with yellowish-brown pubescence. Rachis 4-10 inches long, with a large gland on the petiole .5-1 inch from the base and sometimes 1 or more between the upper pairs of pinnæ; stipules .3 inch long, linear, caducous. Pinnæ (4-) 6-8 (-15) pairs, 3-6 inches long. Leaflets 10-30 pairs, .5-.7 by .15-.25 inch, falcate-oblong, acute, oblique, dark-green above, pale beneath, more or less adpressed hairy on both sides, midrib close to the upper edge, subsessile. Flowers pink (rarely creamy), in peduncled heads, solitary or in fascicles of 2-3 arranged in a short terminal raceme, the lowest often axillary; peduncles 1.5-3 inches long; bracts .15-.3 inch long, linear, caducous; pedicels .05 inch long. Calyx .15 inch long, tubular, pubescent, teeth short, triangular. Corolla .3 inch long, pubescent outside; lobes .1 inch long, lanceolate, acute. Stamens 1-1.3 inches long, staminal-tube about as long as the corolla-tube. Pod 3-5 by .6-1 inch, thin, pubescent till mature, pale-brown or yellowish, with thickened sutures. Seeds 8-12. *A. mollis*, Boiv.

Outer Himalaya from the Indus eastwards ascending to 5,000 or occasionally to 6,000 feet. Not very common. Growth fairly fast and the tree reaches 30-40 feet in height and 5 feet in girth. The heartwood is rather scanty, almost black in old trees, mottled, takes a good polish and is suitable for furniture. The tree is very handsome when in flower and makes an excellent roadside tree for hill roads but it is seldom used for this purpose. Flowers: April—June.

3. *ALBIZZIA ODORATISSIMA*, *Benth. in Hook. Lond. Journ. Bot.* III (1844) p. 88.—An erect almost evergreen tree with straight stem, bark dark-grey with darker patches, young shoots and inflorescence clothed with brownish tomentum. Rachis 4-8 inches long, with a large gland on the petiole about .5-1 inch from the base and sometimes 1-2 more between the upper pairs of pinnæ. Pinnæ 3-8 pairs, 3-6 inches long. Leaflets 8-20 pairs, .7-1 by .2-.4 inch (in Central India specimens often much larger), oblong, usually obtuse, sometimes acute, midrib about one-third of the breadth of the leaflet from the upper edge, dark-green, pubescent or nearly glabrous above, paler, tomentose or pubescent beneath, subsessile. Flowers

pale-yellow, fragrant, in peduncled heads, solitary or in fascicles of 2-4 arranged in a large terminal panicle, the lower branches axillary; peduncles $\cdot 5\text{--}1\cdot 3$ inches long; bracts $\cdot 1$ inch long, ovate, acute, densely pubescent; pedicels 0. Calyx $\cdot 05$ inch long, densely pubescent, teeth sub-obsolete. Corolla $\cdot 3$ inch long, grey-pubescent outside; lobes $\cdot 1$ inch long, lanceolate, acute. Stamens $\cdot 6$ inch long, staminal-tube half as long as the corolla-tube. Pods 4-12 by $\cdot 7\text{--}1\cdot 2$ inches, thin, flexible, reddish-brown, tomentose when young, glabrous when old, shortly stipitate. Seeds 8-12. *The Black Siris.*

Sub-Himalayan tract from the Indus eastwards ascending to 3,000 feet. Fairly common in Kangra and locally common in Rawalpindi near Salgraon. Sapwood rather large, heartwood dark-brown with darker streaks, seasons works and polishes well and is fairly durable. In suitable places it regenerates well, the young seedlings standing a considerable amount of shade. The tree is worth trying in irrigated plantations. Flowers: April—June.

4. *ALBIZZIA GAMBLERI*, Prain, in *Journ. As. Soc. Beng.* LXVI (1897) p. 513.—A tree 50 feet high. Rachis 3-4 inches long, with a large gland on the petiole $\cdot 25$ inch from the base. Pinnæ 2-3 pairs, 1-4 inches long, with large projecting glands between the distal pair of leaflets. Leaflets 3-7 pairs, decreasing slightly downwards, $\cdot 6\text{--}2$ by $\cdot 4\text{--}1$ inch, ovate-lanceolate, acute or subacute, base cuneate from the middle, pale-green above, glaucescent beneath, sparsely adpressed-puberulous on both sides. Flowers in peduncled heads arranged in terminal and axillary panicles; peduncles fascicled, about 1 inch long; pedicels $\cdot 02$ inch long. Calyx $\cdot 1$ inch long, campanulate, puberulous, teeth minute, ovate. Corolla $\cdot 2$ inch long, teeth small, oblong-lanceolate. Stamens $\cdot 3\text{--}4$ inch long, staminal-tube about as long as the corolla-tube. Pod 6-8 by 1-1 $\cdot 5$ inches, pale straw-colored, thin, firm, strap-shaped, faintly reticulate, narrow-cuneate at the base. Seeds 6-8.

Kangra District. Resembles *A. Lebbek* very closely but has much shorter peduncles. Has only been collected once in the Panjab. (? Cultivated)

5. *ALBIZZIA LEBBEK*, Benth. in *Hook. Lond. Journ. Bot.* III (1844) p. 87.—A large deciduous tree, bark dark-grey, irregularly cracked, young shoots and inflorescence pubescent. Rachis 3-6 inches long, usually with a large gland on the petiole $\cdot 5\text{--}1\cdot 5$ inches from the base and often one or more between the upper pairs of pinnæ; stipules $\cdot 15$ inch long, linear, tomentose, caducous. Pinnæ (1-) 2-3 (-4) pairs, 2-8 inches long, often with glands between the upper pairs of leaflets or between all the leaflets. Leaflets 3-9 pairs, 1-2 by $\cdot 6\text{--}1$ inch, the lateral oblong, the terminal obovate, pale-green, inequilateral, obtuse or retuse, glabrous or pubescent; petiolules very short. Flowers whitish, very fragrant, in pedunculate heads, peduncles 2-4 inches long,

solitary or in fascicles of 2-4 from the axils of the upper leaves; bracts .2 inch long, linear, tomentose, caducous; pedicels .1 inch long, slender, pubescent. Calyx .15 inch long, campanulate, pubescent; teeth short, deltoid. Corolla .3 inch long, funnel-shaped; lobes ovate, acute, pubescent on the backs. Stamens 1-1.5 inches long, staminal-tube a little shorter than the corolla-tube. Pod 6-12 by 1-2 inches, thin, flat, strap-shaped, rounded at both ends, pale straw-colored, reticulately veined. Seeds 6-10. *The Siris*. Vern. *Siris*.

Sub-Himalayan tract and Outer Himalaya ascending to 4,000 feet from the Indus eastwards. Cultivated everywhere in the plains. The *Siris* is conspicuous for the greater part of the year owing to its pods which remain hanging on the tree long after they are ripe and throughout the hot weather when the tree is bare of leaves. When rattled by the hot winds they make a sound which bears a more than fancied resemblance to frying fish and hence the tree is known in the West Indies as the *Fry wood*. The growth is very fast but young plants are frequently cut to the ground by frost. The sapwood is large and readily eaten by insects, the heartwood is dark-brown with lighter and darker streaks. It much resembles walnut, seasons works and polishes well and is excellent for furniture. It is also used for cane-crushers, oil-mills, wheel-work, etc. Flowers: April—May.

6. *ALBIZZIA PROCERA*, Benth. in Hook. Lond. Journ. Bot. III (1844) p. 89. A large deciduous tree, with tall erect stem, bark pale, yellowish or greenish-grey, smooth, young shoots and inflorescence glabrous. Rachis 12-18 inches long, with a large oblong gland near the base of the petiole. Pinnæ 2-6 pairs, 5-9 inches long, usually with 1 or 2 oval glands between the upper pairs of leaflets. Leaflets 6-16 pairs, 1-2 by .6-.9 inch, ovate-oblong, oblique, obtuse, minutely adpressed-pubescent on both sides or glabrescent, bright-green above, paler beneath, the midrib nearer the lower edge; petiolules .05 inch long. Flowers greenish-yellow, in peduncled heads arranged in large lax terminal panicles; peduncles usually in fascicles of 2-5, sometimes solitary, .5-1 inch long; pedicels 0. Calyx .1 inch long, glabrous, teeth triangular, acute. Corolla .2 inch long, lobes lanceolate, as long as the tube, pubescent on the backs. Stamens .4 inch long, staminal-tube as long as the corolla-tube. Pods 4-8 by .7-1 inch, glabrous, brown, thin, flexible, very shortly stipitate. Seeds 6-12. *The White Siris*.

Indigenous east of the Jumna in moist places. Much planted in the Punjab as far west as the Indus and occasionally seen as a roadside tree in the Sub-Himalayan tract. The growth is very fast, sapwood large not durable, heartwood brown with alternate bands of lighter and darker color. Flowers: June—August.

ALBIZZIA LUCIDA, Benth.—A large nearly evergreen tree. Pinnæ 1-2 pairs. Leaflets 1-6 pairs, 2-5 inches long, elliptic, acuminate, shining. Flowers sessile in peduncled heads arranged in a terminal panicle. Pods 6 by 1 inch, dark-brown.

Indigenous to the Sub-Himalayan tract from Nepal eastwards. Cultivated in the plains of the Punjab, does well and is a handsome tree. Flower : May—June.

ALBIZZIA LOPHANTHA, *Benth.*—An Australian shrub distinguished from all the indigenous species by having flowers in spikes. Has been cultivated on a fairly large scale by the Forest Department as it was hoped that it would be useful for reclothing denuded hillsides. It was tried in the Simla Water Supply Catchment Area and in many other places including Lahore. It proved an absolute failure dying in the first monsoon at low elevation and being killed by frost at the higher.

35. *ACACIA*, Willd.

(The classical name of one of the species, probably *Acacia arabica*.)

Trees or shrubs, erect or climbing, usually armed. Leaves bipinnate [in the large Australian section *Phyllodineæ*, reduced to flattened leaf-like petioles (phyllodia)]; stipules 0 or small, membranous or transformed into straight or recurved spines. Flowers small, bisexual or polygamous, usually 5-merous, in globose heads or cylindric spikes which are solitary or fascicled in the leaf-axils or arranged in terminal or axillary racemes or panicles. Calyx usually campanulate, shortly toothed. Petals free or more or less united amongst themselves or to the stamens. Stamens indefinite, much exserted, free or very shortly and irregularly connate at the base; anthers small, eglandular. Ovary sessile or stipitate; ovules 2-many; style filiform; stigma small, terminal. Pod various, not jointed. *DISTRIB.* Species 450; two-thirds of the genus belonging to the section *Phyllodineæ*, the rest cosmopolitan in the tropical and sub-tropical regions of the world.

A. Erect trees or shrubs.

I. Spines subulate, straight. Flowers in globose heads.

(a) Heads axillary, pedunculate.

A tree; pod moniliform, tomentose ... 1. *A. arabica*.

Shrubs; pods not moniliform, glabrous.

Pod cylindric, turgid, pulpy within ... 2. *A. Farnesiana*.

Pod flattened, dry.

Pod 3-6 by 2-3 inch, sutures undulate ... 3. *A. sp.*

Pod 2-3 by 5-6 inch, sutures straight... 4. *A. Jacquemontii*.

(b) Heads terminal, paniculate.

A tree; pod not moniliform, tomentose ... 5. *A. leucophlœa*.

II. Prickles compressed or recurved. Flowers in spikes.

Pinnæ 10 pairs or more ... 6. *A. Catechu*.

Pinnæ 5 pairs or fewer.

Prickles in threes; pinnæ 3-5 pairs ... 7. *A. Senegal*.

Prickles in pairs; pinnæ 2-3 pairs ... 8. *A. modesta*.

B. Climbing shrubs, stems prickly, rarely unarmed on flowering shoots.

Stems fluted and angled; leaflets .08-.2 inch

wide; pod tomentose when young, light-brown, not shining ... 9. *A. cæsia*.

Stems round; leaflets .05 inch wide; pod glabrous, dark-brown, shining ... 10. *A. pennata*.

1. *ACACIA ARABICA*, Willd. *Sp. Pl.* IV (1805) p. 1085.— A moderate-sized evergreen tree, bark dark-brown or blackish with longitudinal fissures, young twigs pubescent. Spines stipular, in pairs below the petioles, straight, subulate, large on young, small or wanting on old plants, ivory-white, .3-2 inches long. Rachis 1-3 inches long, downy, often glandular. Pinnæ 3-10 pairs, .5-1.5 inches long. Leaflets 10-20 pairs, .1-1.2 inch long, linear, glabrous or nearly so, subsessile. Flowers yellow, in globose pedunculate heads, .5 inch diameter; peduncles .5-1 inch long, slender, downy, in axillary fascicles of 2-6; bracts 2-4, above the middle of the peduncle, minute, ovate, acute. Calyx .05 inch long, campanulate. Corolla twice as long as the calyx. Pod 3-6 by .5-.6 inch, stipitate, moniliform, compressed, densely grey-tomentose, subindehiscènt. Seeds 8-12. *The Babul*. Vern. *kikar*.

Indigenous to Sind, the Deccan and Tropical Africa. Planted throughout the plains of the Punjab and completely naturalized in the cultivated tracts excluding the northern part of the Sind-Sagar Doab. With the extension of cultivation the *kikar* has become one of the commonest if not the commonest tree in the Punjab. It is cultivated largely by natives as well as by the Canal Department in plantations along canal spoil banks. Seedlings spring up readily on fallow land and on the edges of fields and though many are killed by the severe frosts which every 3 or 4 years kill all *kikar* seedlings up to 6 or 8 feet in height in the central parts of the Province, many escape as the growth is very fast and 2 or 3 years with mild winters enable the seedlings to grow above the danger zone. *Kikar* was tried in Changa Manga when the plantation was started and though the growth was promising for a time the frosts proved too severe and comparatively few plants survived in the final crop. These disappeared after the first felling as *kikar* is a tree which for practical purposes does not coppice. The *kikar* in the Punjab attains a girth of 2½ feet in about 12 years and 5 feet in about 30 years. The wood is hard, reddish-brown, mottled with dark streaks, it is very durable and is used for many agricultural and domestic purposes. The bark is used for tanning and the pods when unripe are rich in tannin. The branches are lopped for feeding goats and camels and are used for fencing fields. From wounds in the bark a gum exudes which is used in place of, though much inferior to, gum arabic. The *kikar* is a very valuable tree for the native cultivator as in addition to the many useful products it yields it stands lopping and ill-treatment well and its shade is very light and causes little injury to crops. The *kikar* prefers a loose porous soil but will grow on stiff soils or *kankar*, it also stands a saline soil better than most trees. Flowers: July—November.

2. *ACACIA FARNESIANA*, Willd. *Sp. Pl.* IV (1805) p. 1083.— An evergreen shrub, bark dark-grey, smooth, branches slightly zig-zag, marked with pale-grey or pale-brown raised dots, young twigs glabrescent. Spines stipular, in pairs below the petioles, straight, whitish, .3-.7 inch long. Rachis .5-2 inches long, pubescent, channelled above, the larger with a small gland about the middle of the petiole. Pinnæ 2-8 pairs, .5-1 inch long. Leaflets 10-20 pairs, .1 or less to .2 inch long, linear-oblong, acute, base oblique; nearly or quite glabrous, sessile. Flowers yellow, fragrant, in globose pedunculate heads .4-.6 inch diame-

ter; peduncles .5-1 inch long, in axillary fascicles, slender, pubescent; bracts reflexed, ciliate, whorled at or near the apex of the peduncle. Calyx .07 inch long, campanulate. Corolla .1 inch long. Pod 2-3 by .5 inch, subcylindric, turgid, dark-brown; mesocarp pulpy. Seeds numerous, biseriate.

Said to be a native of America, it is now cosmopolitan being truly wild, naturalized or cultivated in all warm countries. In the Punjab it is found mainly on sandy soils being common and gregarious on islands in the Beas and as an undergrowth in the Ludhiana plantation. It is cultivated throughout the plains and up to 3,000 or 4,000 feet in the Outer Himalaya, usually as a hedge plant and is often seen growing spontaneously. The plant yields a high class gum and the flowers are used for perfume in South Europe but neither of these products is utilized in India. The freshly felled wood has a very peculiar and rather offensive odor. Flowers: January—March.

3. *ACACIA* SP.—A slender deciduous shrub 4-6 feet high, bark smooth, dark-grey, twigs glabrous, slightly zig-zag. Spines stipular, in pairs below the petioles, straight, rather slender, ivory-white, .5-1 inch long. Rachis .15-1.5 inches long, glabrous, the longer with a circular or oval gland in the middle of the petiole and a circular gland between the last pair of pinnæ, the shorter eglandular. Pinnæ 1-4 pairs, .2-.5 inch long. Leaflets 4-8 pairs, .1-.15 inch long, elliptic-oblong, thick, glabrous, subacute, base slightly oblique, petiolules very minute. Flowers yellow, in globose pedunculate heads .4-.5 inch diameter; peduncles .2-.5 inch long, axillary, solitary or twin, glabrous; bracts 3, in, above or below the middle of the peduncle. Calyx .06 inch long, campanulate. Corolla scarcely twice as long as the calyx. Pod 3-4 by .2-.25 inch, flat, straight or curved, stipitate, indented on both sutures, longitudinally veined, glabrous. Seeds 1-8, areole not well marked.

The plains, Salt Range and Sub-Himalayan tract from the Jhelum westwards. Very common on dry arid rocky or gravelly soils. Flowers: September—March. In habit it greatly resembles *A. Jacquemontii*, Benth., but in that species the peduncles are in fascicles of 2-8, the heads .3 inch diameter and the corolla more than twice as long as the calyx. The pod is very different. In most respects it resembles *A. eburnea*, Willd. which is a small tree. The spines are dull pale-brown. Twigs, rachises and petioles loosely hairy. Flowers pink or yellow tinged with dark purple. Peduncles .7-1 inch long. Seeds with a well-marked areole. *A. eburnea* is found east of the Jumna but has not been collected in the Punjab. It is found on sandy soil along streams, not in dry rocky places.

4. *ACACIA JACQUEMONTII*, Benth. in Hook. Lond. Journ. Bot. I (1842) p. 499.—An erect deciduous shrub 4-8 feet high, bark smooth, greyish-brown, twigs zig-zag, young shoots slightly puberulous. Spines stipular, in pairs below the petioles, straight, ivory-white, connate at the base, .5-2 inches long. Rachis .3-2 inches long, glabrous, usually with a gland between the upper pair of pinnæ. Pinnæ 1-4 pairs, .2-.6 inch long. Leaflets 5-10 pairs, .1-.15 inch long, oblong, obtuse, thick, glabrous,

coriaceous, sessile. Flowers yellow, fragrant, in globose pedunculate heads, .3 inch diameter; peduncles .5 inch long, slender, glabrous, in axillary fascicles of 2-8, rarely shortly racemose or umbellate; bracts 2-3, about the middle of the peduncle. Calyx .04 inch long, campanulate. Corolla .1 inch long, more than twice as long as the calyx. Pod 2-3 by .5-.6 inch, flat, straight, stipitate, reticulately veined, glabrous. Seeds 5-6.

The plains in the south and south-east Punjab, Delhi, Hissar, Montgomery and Muzaffargarh. A characteristic plant on dry sandy soils in Northern Rajputana, where it is confined to the sand and does not grow on the rocky hills. Exceedingly like the preceding except in fruit but with a different distribution. The flower heads are however almost always in more numerous fascicles. Flowers: February—May.

5. *ACACIA LEUCOPHLOEA*, Willd. *Sp. Pl.* IV (1805) p. 1083.—A moderate sized deciduous tree with short bole, bark pale-grey and smooth on young stems, dark-brown or blackish and rough on old stems, young shoots and inflorescence densely grey-pubescent. Spines stipular, in pairs below the petioles, straight, dark-brown, .1-1 inch long, or wanting. Rachis 1-4 inches long, usually with glands between the lowest and between the 2-3 uppermost pairs of pinnæ. Pinnæ 5-15 pairs, .7-1.5 inches long. Leaflets 12-30 pairs, .1-.2 inch long, linear-oblong, crowded, glabrous or nearly so, obtuse, base oblique, sessile. Flowers creamy-white, in globose pedunculate heads .25 inch diameter, arranged in large terminal tomentose panicles, the lower branches axillary; heads geminate, racemosely arranged on the branches of the panicle; peduncles of the heads .3-.4 inch long, tomentose; bracts whorled, about the middle of the peduncle. Calyx .05 inch long, campanulate, villous. Corolla twice as long as the calyx, hairy outside. Pod 4-6 by .3-.4 inch, linear, flat, sessile, subindehiscent, brown-velvety when young. Seeds 10-20. Vern. *Réru*.

Plains of the Central and Eastern Punjab, Sub-Himalayan tract and Siwalik Hills from the Ravi eastwards. Common in the *rakhs* east of the Ravi, less frequent in the Sub-Himalayan tract. Sapwood large, heartwood reddish-brown, with lighter and darker streaks, hard and tough but not durable. Used only for firewood for which it is excellent. Rather an ugly tree easily recognized by its terminal panicles of flowers or brown-velvety pods. Flowers: August—November.

6. *ACACIA CATECHU*, Willd. *Sp. Pl.* IV (1805) p. 1079.—A small or medium-sized deciduous tree, bark dark-grey, rough with long narrow-rectangular plates, young twigs puberulous. Prickles pseudo-stipular, in pairs below the petioles, strongly compressed with long bases, recurved, dark-brown or blackish, about .2 inch long, often wanting on old plants. Rachis 3-6 inches long, pubescent, often prickly, with a large gland near the base of the petiole and often several smaller glands between the pinnæ. Pinnæ 10-30 pairs, 1-1.5 inches long. Leaflets 30-50

pairs, about .15 inch long, linear, subacute, base very oblique, ciliate; petiolules minute. Flowers pale creamy-white, in cylindric axillary pedunculate spikes, 2-4 inches long, usually solitary; peduncles .5-.7 inch long. Calyx .05 inch long, campanulate, grey-pubescent outside. Corolla 2-3 times as long as the calyx, slightly pubescent. Pod 2-3.5 by .5-.6 inch, on a stipe .2-.3 inch long, thin, flat, straight, beaked, dehiscent. Seeds 3-6. *The Khair*. Vern, *khair*.

Sub-Himalayan tract and Outer Himalaya ascending to 3 or 4,000 feet from the Indus eastwards. Usually on rather dry hillsides or as an undergrowth in Chil forests. In other provinces it is often found growing gregariously either pure or mixed with Sissoo, on banks and islands in streams but in the Punjab it is not often seen in these localities but is a common constituent of the dry scrub forests. Heartwood rather small, dark-red, very hard and durable and not eaten by white ants. Although the tree does not reach a large size as a rule it is much in demand for posts. It is also an excellent firewood and one of the best woods for charcoal. The growth is moderately fast and consequently khair is a better tree to sow in blanks in the scrub forests than is phulai but it is much less often sown. The wood is rich in tannin and from it extracts known as *Kāth* and *Cutch* may be prepared. The former is used for chewing with *betel* and the latter for tanning but neither product is of importance in the Punjab. The khair is more sensitive to frost than is the phulai and it was badly damaged in the winter of 1904-05 in the Hazara District at 3,000 feet in common with most of the indigenous vegetation. Flowers: May—July.

7. *ACACIA SENEGAL*, Willd. *Sp. Pl.* IV (1805) p. 1077.— A small (deciduous?) tree 10-20 feet high, bark smooth, pale greenish-grey, on older stems peeling off in thin flakes of a darker color, young twigs slightly puberulous. Prickles in threes at the base of the petioles, the pseudostipular straight or upcurved, the third placed between the other two and recurved, all strongly compressed from long bases, dark-brown, polished, about .2 inch long. Rachis 1-2 inches long, sometimes weakly prickly with glands between the lowest and uppermost pairs of pinnæ. Pinnæ 3-5 pairs, .5-1 inch long. Leaflets 8-15 pairs, .1-.2 inch long, linear, obtuse, subsessile. Flowers white, fragrant, in cylindric 1-3-nate axillary pedunculate spikes, 2-4 inches long; peduncles .3-.7 inch long. Calyx .07 inch long, broadly campanulate, glabrous. Corolla .1 inch long. Pod 2-3 by .7-1 inch, thin, flat, straight, shortly stipitate, abruptly narrowed at the apex into a short curved beak. Seeds 5-6. *A. rupestris*, Stocks. Brandis, Ind. Trees fig. 116.

South-East Punjab, Rohtak. Abundant in Rajputana, growing mainly on the dry rocky hills but also on sandy soils. It has been tried in the Pabbi Hills as well as at Changa Manga and grew well for a time but was soon lost sight of. It should be tried again in the Pabbi Hills as it is likely to be useful for afforestation having been used successfully in Jaipur State, Rajputana, for reclothing bare rocky hills and shifting sand. The tree regenerates much more freely than *phulai* which in many respects it resembles and for which it is easily mistaken at a little distance. Wood hard, sapwood yellowish,

heartwood nearly black. It takes a beautiful polish and is used for weavers' shuttles. This tree yields the true *gum-arabic* of commerce. Flowers: August—November.

8. *ACACIA MODESTA*, Wall. *Pl. As. Rar.* II (1831) p. 27, t. 130.—A small or medium-sized deciduous tree, young shoots glabrous or nearly so. Prickles pseudostipular, in pairs below the petioles, compressed, strongly recurved, dark-brown, shining, about .2 inch long. Rachis .5-2 inches long, with a small gland at the base of the petiole and sometimes one between the uppermost pair of pinnæ. Pinnæ 2-3 pairs, .5-1 inch long. Leaflets 3-5 pairs, .15-.4 inch long, broadly ovate or obovate, oblique, obtuse, glaucous, petiolules minute. Flowers pale creamy-white, in cylindric axillary solitary or geminate pedunculate spikes 1.5-3 inches long; peduncles about .3 inch long. Calyx .03 inch long, broadly campanulate, glabrous. Corolla about twice as long as the calyx. Pod 2-3 by .3-.6 inch, thin, flat, straight, apex deltoid with a small straight beak, base attenuated into a distinct stipe, late in dehiscing. Seeds 3-5. *The Phulai*. Vern. *Phulai*.

Sub-Himalayan tract and Outer Himalaya from the Jumna westwards ascending to 4,000 feet. Salt Range and the elevated portion of the Sind-Sagar Doab. Occasionally found in the plains further east extending down the Beas and Sutlej well out into the plains on sandy soils. It is not found naturally on loamy soils but has been introduced and is often found self-sown or planted in some of the plains *rakhs* and plantations. The *phulai* reaches a height of 20-30 feet and a girth of 10-12 feet. The growth is very slow, plantations made in the Sub-Himalayan tract reached a height of 18-20 feet in as many years but the girth was only about 1 foot at the base. The sapwood is large, heartwood dark-brown with black streaks extremely hard and durable. It is used for cane-crushers, Persian wheels and agricultural implements and also very largely for fuel. Regeneration by seed is often disappointing but the coppice reproduction is excellent. The *phulai* is often grown in hedges for which purpose it is very good. Flowers: March—May.

9. *ACACIA CÆSIA*, Willd. *Sp. Pl.* IV (1805) p. 1090.—A large scrambling or climbing shrub, stems prickly when young, prominently fluted and angled when old, prickles numerous, small or .1 inch long, straight or hooked. Rachis 5-7 inches long, hairy, with a gland near the base of the petiole and sometimes 2-3 between the upper pinnæ, usually prickly on the back, stipules not spinescent, linear, caducous. Pinnæ 6-16 pairs, 2-4 inches long. Leaflets 10-30 pairs, .2-.4 by .08-.2 inch, oblong, crowded, falcate, oblique, obtuse or acute, more or less pubescent, bright glossy-green above, pale or rusty beneath, sessile, the midrib starting from near the centre of the base of the leaflet. Flowers pale creamy-white, in globose pedunculate heads .4-.5 inch diameter, arranged in large terminal panicles the lower branches of which are axillary; peduncles of the heads 1.5-nate, .4-.7 inch long, downy. Calyx .07 inch long, campanulate. Corolla twice the length of the

calyx. Pod 4-6 by $\cdot 7 \cdot 1 \cdot 2$ inches, thin, flat, stipitate, the sutures slightly thickened and very obscurely winged, tomentose when young, light-brown glabrous not shining when mature. Seeds 6-10. *A. Intsia*, Willd.

Sub-Himalayan tract from the Ravi eastwards. Usually in rather moist places. Common in Kangra and easily recognized by its peculiar stem. Flowers: August—September.

10. *ACACIA PENNATA*, Willd. *Sp. Pl.* IV (1805) p. 1090.—A scrambling or climbing shrub, stems rounded, with 5 lines of very small prickles even when old. Stipules not spinescent, prickles numerous, small to $\cdot 1$ inch long, straight or hooked, often wanting on flowering shoots. Rachis 3-10 inches long, hairy, channelled above, copiously or sparsely prickly or unarmed, with a large gland near the base of the petiole and usually 2-4 smaller glands between the upper pairs of pinnæ. Pinnæ 8-18 pairs, $1 \cdot 5$ -4 inches long. Leaflets 30-50 pairs, $\cdot 15$ - $\cdot 25$ by $\cdot 05$ inch, linear, obtuse, oblique, crowded, glabrous, sessile on a ridge of the rachis of the pinnæ, the midrib starting from close to the upper edge of the base of the leaflet. Flowers white, in globose pedunculate heads $\cdot 3$ - $\cdot 4$ inch diameter arranged in large terminal panicles, the lower branches of which are axillary; peduncles of the heads 1-4-nate, $\cdot 4$ - $\cdot 7$ inch long, downy. Calyx $\cdot 07$ inch long, campanulate, glabrous. Corolla one and a half times as long as the calyx. Pod 4-8 by $\cdot 6$ - $1 \cdot 2$ inches, straight, flat, thin, stipitate, the sutures slightly thickened, glabrous, dark-brown and shining when mature. Seeds 8-14.

Sub-Himalayan tract. Has been collected in Kalesar and will probably be found in Kangra. It is common in the Dun and reaches the tops of tall trees. Flowers: August—September.

ACACIA DEALBATA, Link. *Enum. Hort. Berol.* 445.—A moderate sized evergreen tree, bark grey, nearly smooth, twigs angular, glaucous and hoary as is also the foliage. Leaves 2-6 inches long, rachis usually with a gland below each pair of pinnæ on the upper side; pinnæ 10-20 pairs; leaflets $\cdot 2$ inch long, crowded, linear, 30-40 pairs. Flowers yellow, in small globular heads $\cdot 3$ inch diameter, in axillary and terminal panicles. Calyx minute, lobed, hidden in bud by peltate ciliate bracts. Corolla about twice as long as the calyx, petals equal, united below, free above. Stamens numerous, free, 3-4 times as long as the calyx. Ovary sessile, hairy, style exceeding the stamens. Pod 3-4 by $\cdot 3$ inch, scarcely constricted between the seeds. Seeds ovate, $\cdot 2$ inch long, supported by a small pale-colored aril.

Native of Eastern Temperate Australia. The *Silver Wattle* is cultivated near Simla and is occasionally seen elsewhere. It will not grow in the plains and I have not seen it below 4,000 feet. In Australia it reaches 100 feet in height and 11 feet in girth; the largest tree I have seen near Simla was 4 feet girth and 40-50 feet high. Flowers in February and early March; the flowers are fragrant and ornamental. The tree was tried for afforestation purposes together with *Robinia* but on a smaller scale. It has been rather more successful than *Robinia* and should be cultivated more largely as it will grow on shallow soil and produces root-suckers in great abundance, the growth too is fast. It is seen between 6,000 and 8,000 feet and although it suffers from snow-break at the higher elevations this is of no consequence in a tree wanted

for soil protection. In 1905 it suffered considerably from frost but it is not very sensitive. I have seen a tree growing out of doors in South England (Dorset) 40 feet high, 4 feet in girth and 16 years old. The wood is not likely to be of value except as fuel but the bark yields about 20 % of tannic acid and might be useful. According to Maiden (Forest Flora of N. S. W., III, 56) who considers *A. dealbata* a variety of *A. decurrens*, Willd. "Where var. *dealbata* and var. *mollis* occur in the same district, the former prefers the river banks and valleys and the latter the mountain slopes." From this it seems probable that *A. decurrens*, var. *mollis*, would be even more useful for afforestation than *A. dealbata* and it is a much more valuable tan-bark containing 30-35 % of tannic acid.

Many other Australian members of this genus have been tried especially *Acacia melanoxylon*, R. Br. and *A. decurrens*, Willd. They do not appear to have succeeded anywhere in the hills and in the plains cannot stand the monsoon. Many of the species of the section *Phyllodineæ* appear unable to endure the combined heat and damp of the monsoon: though several have been tried hitherto the following only appear to have succeeded:—

ACACIA AURICULIFORMIS, *A. Cunn.*—An ornamental tree from Tropical Australia. Phyllodia 5-8 by 1-2 inches, falcate, narrowed at both ends, with numerous fine parallel veins. Flowers yellow, in spikes, paniced at the tips of the branches. Pod spirally curved.

ACACIA HOMALOPHYLLA, *A. Cunn.*—A small tree with pale foliage. Phyllodia 1-3 by 1-3 inch, pale or hoary, nerves faint. Flowers yellow, in globose heads.

Indigenous to the dry interior of Australia. The wood is dark-brown, fragrant with the odor of violets. It is valued for small ornamental work. Flowers in Lahore in December.

ACACIA ANEURA, *F. v. M.*—A shrub or small tree. Phyllodia 1-5-3 by 1-3 inch. Flowers yellow, in axillary spikes.

Indigenous to the dry interior of Australia. The wood is excessively hard, dark-brown, durable. The growth is slow. Flowers in Lahore in June.

ACACIA FILICINA, *Willd.*—An unarmed shrub 6 feet high, glabrous or pubescent. Pinnæ 5-20 pairs. Leaflets 10-60 pairs, 15-2 inch long, linear. Petiole and rachis eglandular. Flowers creamy, in axillary heads. Pod 1-2 by 3 inch, stipitate, thin, flat.

Indigenous to Tropical America. Recently introduced in Lahore and flowers very freely from May to October.

Two Mexican species have been introduced and are grown in Lahore, they are of interest owing to the large hollow thorns being occupied in their native country by ants which are supposed to protect the trees in which they live from leaf-eating insects. They are *A. spharocephala*, Cham. & Schl. with whitish thorns and globose flower heads and *A. spadicegera*, Cham. & Schl. with dark-brown thorns and flowers in thick spikes. The latter has been grown for many years and the former since 1909.

36. MIMOSA, Linn.

(From the Greek *mimos*, a mimic; referring to the leaves in many species being sensitive to touch and imitating animal movements.)

Herbs, shrubs or small trees, with or without prickles. Leaves bipinnate, very rarely wanting or reduced to phyllodia. Flowers (3-) 4-5 (-6)-merous, bisexual or polygamous, in dense globose heads or cylindric spikes. Calyx small or almost wanting, less often campanulate and toothed. Petals more or less connate. Stamens free, exserted, as many as or twice

as many as the petals; anthers small, eglandular. Ovary sessile or shortly stipitate; ovules 2-many; style filiform; stigma small, terminal. Pod linear or oblong, compressed, rarely turgid, made up of 1-seeded joints which separate when ripe from the persistent sutures. **DISTRIB.** Species about 230; mainly in Tropical and Sub-Tropical America, a few in Africa and Asia.

Rachis 4-9 inches long, pinnae 5-12 pairs;
sutures of pod not prickly ... 1. *M. rubicaulis*.

Rachis 5-2 inches long, pinnae 3-6 pairs;
sutures of pod prickly ... 2. *M. hamata*.

1. *MIMOSA RUBICAULIS*, Lamk. *Encyc. Méth.* I (1783) p. 20.—A large straggling deciduous shrub, branches long and little branched, striate, more or less pubescent. Prickles usually numerous, straight or hooked, .1 inch long or less. Rachis 4-9 inches long, usually very prickly. Pinnae 5-12 pairs, 1-2·5 inches long. Leaflets 6-15 pairs, .15-·3 by .08-·12 inch, oblong, obtuse, mucronate, the midrib excentric, glabrous above, paler and more or less pubescent beneath, ciliate; petiolules minute. Flowers pink fading to white, tetramerous, in globose pedunculate heads .5-·6 inch diameter; peduncles 1-2 inches long, pubescent, in axillary fascicles forming large terminal leafy panicles. Flowers minutely pedicelled in the axil of a small, linear-spathulate, ciliate bract. Calyx minute, ciliolate. Corolla .12 inch long, cleft one-third the way down. Stamens 8. Ovary shortly stipitate, glabrous. Pods 3-4 by .4 inch, flat, falcate, glabrous, joints 4-10, square, sutures not prickly. Brandis, Ind. Trees, fig. 114.

Sub-Himalayan tract and Outer Himalaya from the Indus eastwards ascending to 4,000 feet. Very common in ravines and grass-lands, also in the scrub and chil forests. Flowers: July—September.

2. *MIMOSA HAMATA*, Willd. *Sp. Pl.* IV (1805) p. 1033.—A low much-branched shrub, branches pubescent. Prickles numerous, hooked, up to .2 inch long. Rachis 5-2 inches long, sometimes prickly. Pinnae 3-6 pairs, .3-1 inch long. Leaflets 6-10 pairs, .1-·15 by .08-·1 inch, ovate-oblong, acute, mucronate, glabrescent above, pubescent beneath, the midrib slightly excentric; petiolules minute. Flowers pink, tetramerous, in globose pedunculate heads .5-·6 inch diameter; peduncles .6-1·2 inches long, pubescent, solitary or paired in the upper leaf-axils. Flowers sessile in the axil of a small linear-spathulate, ciliate bract. Calyx very small. Corolla .12 inch long, cleft half-way down. Stamens 8. Ovary stipitate, pubescent. Pods 2-3 by .4 inch, flat, falcate, pubescent, joints 4-8, sutures undulate prickly.

South-East Punjab Plains; Hissar, Sirsa. Flowers: August—September.

MIMOSA PUDICA, Linn.—*The Sensitive Plant*.—An undershrub easily recognized by its very sensitive leaves. Pinnæ 1-2 pairs crowded at the end of the rachis so as to appear digitate. Flowers pink. Pod with very bristly sutures.

A native of Tropical America often grown as an annual in gardens in the Punjab. It has run wild in many parts of India being common on waste and fallow land near Dehra Dun and is likely to extend into the moister parts of the Punjab if it has not already done so.

37. DESMANTHUS, Willd.

(From the Greek *desme*, a bundle, and *anthos*, a flower. DISTRIB. Species 9; Tropical America, one in Madagascar.)

DESMANTHUS VIRGATUS, Willd. *Sp. Pl.* IV (1805) p. 1047.—A nearly glabrous erect shrub, branches long, slender, little-branched, twigs green, ribbed. Rachis .5-1.5 inches long, with a large gland at the base of the petiole, prolonged beyond the last pair of pinnæ as a short soft bristle. Pinnæ 2-5 pairs, .5-1 inch long. Leaflets 12-18 pairs, .15 inch long, oblong, very oblique, the midrib starting from near the upper edge at the base, sessile. Flowers pale yellowish-white, in globose axillary pedunculate heads; peduncles solitary .5-.7 inch long, lengthening up to 2 inches in fruit. Flowers sessile in the axil of a cuspidate bract. Calyx .1 inch long, tubular-campanulate, glabrous. Corolla less than twice as long as the calyx. Stamens 10, free; anthers eglandular. Ovary sessile, glabrous; style filiform; stigma clavate. Pods 2-3 by .1 inch, linear, compressed, glabrous, continuous within, the sutures slightly thickened, dehiscent. Seeds 20-30, placed obliquely.

Indigenous to Tropical America, naturalized here and there in Africa and India. A weed in the Lawrence Gardens, Lahore, and Ram Bagh, Amritsar, and doubtless occurs elsewhere in the Punjab. Common in the Lawrence Gardens, springing up freely in neglected corners when not too moist and reaching a height of 6-8 feet. Flowers: May—September.

38. LEUCÆNA, Benth.

(From the Greek *leukainein*, to whiten; referring to the color of the flowers. DISTRIB. Species 9 in Tropical America, one in the Pacific Islands.)

LEUCÆNA GLAUCA, Benth. in Hook. *Journ. Bot.* IV (1842) p. 416.—A large shrub or small tree, bark greyish-brown, smooth, young shoots clothed with short grey pubescence or tomentum. Rachis 3-6 inches long, pubescent, ending in a soft bristle. Pinnæ 4-8 pairs, 2-3.5 inches long, their rachises pubescent, ending in a soft bristle. Leaflets 10-15 pairs, rather distant, .4-.5 by .1-.15 inch, linear-oblong, acute, glabrous or nearly so, ciliate, glaucous, base oblique, sessile. Flowers whitish, in dense globose pedunculate heads .5-.8 inch diameter; peduncles 1-1.5 inches long, 1-3 together in the upper leaf-axils. Calyx .1 inch long, tubular-campanulate, glabrous; teeth short-villous. Petals free, valvate, .2 inch long, oblong-spathulate, hairy on the backs near the tips. Stamens 10, free, much

exserted; anthers eglandular. Ovary shortly stipitate, pubescent; style filiform; stigma small, terminal. Pods 5-6 by .6 inch, straight, thin, flat, apex triangular, shortly beaked, base attenuate, stipitate, glabrous, dark brown, the sutures slightly thickened, dehiscent. Seeds 15-20, placed slightly obliquely. *The Lead Tree*.

Indigenous to Tropical America, naturalized here and there in Africa and Asia. Grown in gardens in the Punjab and spreads readily from self-sown seeds. It is found in the Phillaur plantation and seedlings come up readily, standing a considerable amount of shade when young. The growth is fast when young, but it is a small tree not more than 30 feet high and about 2 feet in girth. Wood white, hard. Owing to its profuse reproduction in places which suit it this tree would be worth trying for filling up blanks in forests worked for firewood or for obtaining a tree growth in places covered with shrubs. Flowers: June—August.

39. PROSOPIS, Linn.

(From the Greek name used by Dioscorides for the Butter-bur, *Petasites vulgaris*.)

Trees or shrubs, usually armed. Leaves bipinnate, rarely wanting, pinnæ usually 1-2 pairs. Flowers small, 5-merous, in cylindric axillary spikes, rarely in heads. Calyx campanulate, teeth short. Petals connate below the middle or at length becoming free. Stamens 10, free, shortly exserted; anthers tipped with a deciduous gland. Ovary sessile or stipitate; ovules many; style filiform; stigma small, terminal. Pod linear, compressed or almost cylindric, straight, falcate, twisted or spirally wound, turgid, indehiscent; exocarp thin or coriaceous; mesocarp usually thick and spongy; endocarp cartilaginous or papery forming partitions between the seeds or surrounding each seed separately, or rarely the pod almost continuous within. Seeds usually ovoid, compressed. **DISTRIB.** Species 25; in arid or semiarid regions, 2 in Western Asia, 2 in Tropical Africa, the rest American.

Prickles small, conical; leaflets .5 inch long or

less; pods cylindric

Thorns large, subulate; leaflets .7-1.5 inches

long; pods compressed

1. *P. spicigera*.

2. *P. glandulosa*.

1. **PROSOPIS SPICIGERA**, Linn. *Mantiss.* (1767) p. 68.—A small or medium-sized evergreen tree, branches slender, glabrous, armed with short nearly straight somewhat compressed prickles which on older branches have broad conical bases, rarely unarmed. Rachis .5-2 inches long. Pinnæ 1-2 pairs, 1-3 inches long. Leaflets 7-12 pairs, .3-.5 by .1-.15 inch, oblong, oblique, apex usually mucronate, base rounded, 3-nerved, the midrib nearer the upper edge, subsessile. Flowers creamy-white, nearly sessile, in slender pedunculate spikes 2-5 inches long, axillary or arranged in terminal panicles; peduncles .2-1 inch long. Calyx .05 inch long, cup-shaped, truncate or obscurely 5-toothed. Petals .15 inch long, oblong, tips recurved. Pod

5-10 by 2-3 inch, slender, pendulous, cylindric, turgid, torulose, narrowed into a short stalk; exocarp thinly coriaceous; mesocarp pulpy; endocarp papery. Seeds 10-15, oblong-compressed. Vern. *Jand*.

Throughout the plains of the Punjab where the rainfall is less than 30 inches. The chief tree of the *rakhs* where it is seen usually about 20 feet high and 2-3 feet in girth the trees being quite isolated or occurring in isolated groups associated with *Capparis aphylla* and *Salvadora oleoides*. With the extension of irrigation however it is rapidly disappearing as it is a good firewood and readily sold. The stem is commonly straight with a grey roughish bark which exfoliates in numerous thin flakes. The heartwood is rather scanty, purplish-brown, very hard but not durable, but for firewood it is preferred to most other kinds. The tap-root is very strongly developed penetrating the ground vertically to a great depth and it is owing to this that the tree is able to come into fresh leaf and flower at the hottest season of the year. A root exhibited in Paris in 1878 was 86 feet long having penetrated vertically for 64 feet. The foliage is much lopped for fodder and it is rare to find a tree which has not been lopped and mutilated. A girth of 6 feet is exceptional though one of 18 feet girth is recorded by Moir in Jaipur State and I saw one fully this size, probably the tree measured by Moir. A height of 40 feet is also rare though trees in the Punjab have been recorded 60 feet high. Reproduction by seed occurs only in favorable places, the Jand forests maintaining themselves apparently mainly by root-suckers. The growth from coppice is good. The pods are used for fodder and the sweetish pulp around the seeds is eaten green or dry, raw or cooked, especially in times of scarcity. Young plants in very dry years are often completely leafless during the hot weather but bigger plants are evergreen. Flowers: April—May.

2. *PROSOPIS GLANDULOSA*, Torr. *Ann. Lye. N. York*, II (1828) p. 192, t. 2.—A small or medium-sized deciduous tree, branches long, zig-zag, straggling or pendulous, armed with scattered axillary stout subulate thorns 5-2 inches long. Rachis 1-5 inches long, slender, terete, prolonged beyond the last pinnæ as a soft bristle, swollen and glandular at the base. Pinnæ usually 1 sometimes 2 pairs, 3-5 inches long, often glandular between the leaflets. Leaflets 10-18 pairs, 7-1.5 by 1.5-2 inch, rather distant, linear-oblong, falcate, usually acute, midrib almost central, subsessile. Flowers creamy-white, in axillary pedunculate spikes about 3 inches long, solitary or in fascicles of 2-4; peduncles 2-7 inch long. Calyx .05 inch long, campanulate, 5-toothed, teeth ciliate, otherwise glabrous. Petals .15 inch long, oblong, villous within towards the tips. Pod 5-8 by .3 inch, linear, straight or falcate, compressed, turgid, pendulous, distinctly constricted between the seeds when fully ripe, narrowed into a short stalk; exocarp coriaceous; mesocarp pulpy; endocarp cartilaginous surrounding each seed separately. Seeds 12-20, ovoid, compressed. *P. juliflora*, DC. var. *glandulosa*, Sarg. The *Mesquite*.

Indigenous to the Southern United States and Northern Mexico, naturalized in many parts of the Punjab, e.g., on the Canal Bank at Changa Manga, along the North-Western Railway from Gujranwala to Jhelum, at Khushalgarh and especially in the Pabbi Hills. Often grown in gardens and

shows a great tendency to spread in the drier districts but not in places where the rainfall exceeds 30-40 inches. The Mesquite was introduced about 1878 on account of its pods which in its native country are eaten by Indians and given as fodder to horses and cattle. It was tried on a small scale in the Pabbi afforestation area and has been most successful, the growth being faster than *phulai* the species most largely sown and its power of spreading by natural seedlings considerably greater. For reclothing bare ground whether flat or hilly no indigenous tree is likely to prove as useful as the Mesquite in dry and arid districts. The pods being indehiscent and owing also to the inner covering of the seed, the seeds are difficult to clean, the pods are therefore usually broken up into pieces and sown. The seed does not germinate so quickly if sown thus and if the sowing is done late or the rains are not good it may not germinate till the following year. American botanists have followed Benthams in reducing *P. glandulosa*, Torr. to a variety of *P. juliflora*, DC. This view I have not accepted mainly because *P. glandulosa*, Torr. is deciduous whereas all the other forms of *P. juliflora*, DC. *sensu* Benthams with which I am acquainted are evergreen. *P. glandulosa* is described as a tree 20 feet high with a trunk 1 foot in diameter and there are specimens fully this size in the Punjab though as usually seen it is a large shrub with crooked branches from the base. The bark on old stems is dark reddish-brown with longitudinal furrows. The wood is a rich dark-brown or sometimes red with a narrow sapwood. It is said to be "almost indestructible in contact with the soil and largely used for fence posts," etc. (Sargent, Trees of N. Am., p. 549). *P. glandulosa* in the Punjab is usually far too crooked to be of use as timber, but it is an excellent firewood and makes good charcoal.

PROSOPIS JULIFLORA, DC. *Prodr.* II (1825) p. 447. — A small evergreen tree. Branchlets long, spreading, usually unarmed. Rachis 1.5-2.5 inches long, sparsely hairy, prolonged beyond the last pair of pinnae as a soft point, bearing a gland between each pair of pinnae. Pinnae 2-4 pairs, 1.5-2 inches long, sparsely hairy. Leaflets 10-14 pairs, .25-.4 by .08-.12 inch, oblong, minutely mucronate, midrib almost central, sessile. Flowers pale cream colored, in axillary spikes 3-5 inches long in fruit. Otherwise as for *P. glandulosa*.

Cultivated in Lahore and Kapurthala as well as in Saharanpur and Agra. Has long been introduced but is not yet common. Economically this plant appears to resemble *P. glandulosa* but possesses the additional advantage of being evergreen. It is very hardy and grows fast and is likely to be even more useful for reforesting arid ground than *P. glandulosa*.

Prosopis juliflora, DC., as defined by Benthams and others is a composite species. After excluding the deciduous *P. glandulosa*, Torr. there remain a number of forms differing more or less in foliage and habit and pods but not in their flowers. In America the tree extends from Mexico to Chile in various forms and many varieties have been introduced and are in cultivation in Lahore. In addition to the form described above which is grown in Saharanpur, Agra, Kapurthala and doubtless in many other places and has long been introduced there is a form which has been obtained, *via* Australia, two or three others direct from Mexico and one from Peru. One of the Mexican forms is apparently *P. juliflora*, var. *velutina*, Sarg., indigenous to Southern Arizona and Sonora. It is described as a tree 60 feet high and 2 feet diameter and is likely to be a useful timber tree in the Punjab. According to Sargent it differs from *P. glandulosa*, Torr. in having pubescent and more crowded leaflets .25-.5 inch long.

The following plants belonging to the Sub-family *Mimoseæ* are cultivated:—

Pithecolobium dulce, Benth. — A medium-sized evergreen tree armed with pairs of straight stipular spines. Rachis about .5-1 inch long. Pinnae 1 pair. Leaflets 1 pair, about 1 inch by .4 inch, elliptic-oblong, oblique.

Flowers white, in small globose sessile or shortly pedunculate heads arranged in long paniced racemes. Calyx .04 inch long, funnel-shaped, downy. Corolla .12 inch long, petals united below the middle. Stamens monadelphous, much exerted, eglandular. Pod 4-5 by .5 inch, turgid, twisted, sutures indented between the seeds, seeds 5-8, half enveloped in a pink pulpy edible aril. *The Manilla Tamarind*.

Indigenous to Mexico introduced into India *via* Manilla and grown in gardens in the East Punjab. In Lahore it suffers considerably from frost. Seedlings planted in the Changa Manga Rest House Garden grown from seed received in 1912 from Sonora, Mexico, were uninjured by three nights' frost when the shade temperature sank to 27°, 27°, 26° F. although they were only a foot or so high and were quite unprotected. In 1914-15 plants from Indian seed were killed by frost in Lahore but plants from Sonoran seed were uninjured though they were not protected in any way, hence it appears that the Sonora plant is a more frost-hardy variety than the one hitherto grown which has not got beyond the South and Eastern portions of the Province owing to frost. The plant grows fast and gives a hard wood. It is cultivated for fuel and as a hedge plant in South India. Stands a considerable amount of shade.

PIPTADENIA OUDHENSIS, *Brandis*.—A medium-sized tree, branches sometimes prickly. Leaves bipinnate. Pinnæ 2 pairs. Leaflets 1 pair, 2-4 inches long, reniform.

Cultivated in gardens but not as often as it deserves. It is a handsome tree with peculiar foliage and a hard durable wood. In Saharanpur the growth is very rapid and the tree is quite hardy in Lahore.

CALLIANDRA HÆMATOCEPHALA, *Hassk.*—A shrub. Leaves bipinnate, pinnæ 1 pair. Leaflets 4-8 pairs, .7-1.5 inches long, lanceolate, coriaceous. Flowers scarlet, in axillary heads, stamens very numerous, about 1 inch long.

Occasionally grown in gardens, does not do very well in Lahore. Only known in Indian gardens but probably of American origin.

CALLIANDRA GRANDIFLORA, *Benth.*—A tall evergreen shrub. Leaves bipinnate, rachis villous with brown hairs. Pinnæ 15 pairs or more; leaflets 30-60 pairs, densely crowded, .2 inch long, linear-oblong. Flowers scarlet, in heads forming terminal panicles. Stamens very numerous, about 2 inches long. Pods 3-4 by .5-.7 inch, densely villous with red hairs.

Indigenous to Mexico and Guatemala. Cultivated in Lahore. Flowers: May—October.

XXXVII. ROSACEÆ.

Herbs, shrubs or trees. Leaves alternate (very rarely opposite), simple or compound, stipules often adnate to the petiole, rarely wanting. Flowers usually bisexual and regular, generally 5-merous. Calyx-tube free or rarely adnate to the ovary. Disk lining the calyx-tube or annular, usually between the stamens and carpels. Petals rarely wanting, inserted under the margin of the disk, usually with narrow bases. Stamens perigynous, usually indefinite, in one or many series; filaments free, rarely partially united, incurved in bud; anthers small, opening by longitudinal slits, introrse. Ovary of 1 or more, free or connate carpels; styles as many as carpels, free or connate, basal, lateral or subterminal, springing from the ventral suture; ovules usually 1 or 2 in each carpel. Fruit various, often formed in part from the calyx-tube. Seeds exalbuminous. **DISTRIB.**

A large family distributed throughout the world, mainly in temperate regions.

Ripe carpels not enclosed within the calyx-tube.

Carpels solitary.

- Style in fruit subterminal; stone bony ... 1. *Prunus*.
 Style in fruit subbasal; stone coriaceous ... 2. *Prinsepia*.

Carpels 5 or more.

- Prickly shrubs; fruit succulent ... 3. *Rubus*.
 Unarmed shrubs; fruit dry.
 Calyx ebracteolate; fruit dehiscent ... 4. *Spiraea*.
 Calyx bracteolate; fruit indehiscent ... 5. *Potentilla*.

Ripe carpels enclosed within the calyx-tube.

Carpels many, free; prickly shrubs with compound leaves ... 6. *Rosa*.

Carpels 1-5, connate or adnate to the calyx-tube; leaves simple or when compound plant unarmed.

- Ovary 5-celled, cells many-ovuled ... 7. *Cydonia*.
 Ovary 2-5-celled, cells 2-ovuled.
 Fruit a pome, endocarp membranous or cartilaginous ... 8. *Pyrus*.
 Fruit drupaceous, containing 1-5 bony stones.
 Leaves cut, toothed or serrate ... 9. *Crataegus*.
 Leaves entire ... 10. *Cotoneaster*.

1. PRUNUS, Linn.

(The classical name of the Plum tree.)

Trees or shrubs mostly unarmed and deciduous. Leaves simple, entire or toothed; petiole often 2-glandular. Flowers white or pink, solitary, fascicled, corymbose or racemed. Calyx-tube various, partially or completely deciduous in fruit, lobes 5. Petals 5. Stamens usually 20. Carpel 1; style terminal; ovules 2, collateral, pendulous. Fruit a drupe with an indehiscent or two-valved smooth or rugged stone, 1-seeded. DISTRIB. Species 80-100; North Temperate Regions, a few in Tropical Asia and America.

Leaves about 1 inch long, small shrubs.

- Leaves and twigs glabrous ... 1. *P. Jacquemontii*.
 Leaves beneath and twigs pubescent or velvety ... 2. *P. prostrata*.

Leaves exceeding 1 inch long, large shrubs or trees.

Flowers solitary or fascicled.

- Pedicels slender, about as long as the calyx-tube ... 3. *P. cerasoides*.
 Pedicels 0 or short and thick.
 Leaves much longer than broad ... 4. *P. Persica*.
 Leaves nearly as broad as long ... 5. *P. armeniaca*.
 Flowers in racemes ... 6. *P. cornuta*.

1. *PRUNUS JACQUEMONTII*, Hook. f. in *Fl. Brit. Ind.* II (1878) p. 314.—A small deciduous shrub, twigs slender, divaricate, glabrous or puberulous in the leaf-axils and buds. Leaves conduplicate in bud, 1 inch long, elliptic or obovate or narrow-oblong, serrate, dark-green above, pale beneath, glabrous, narrowed into a puberulous petiole $\cdot 1\text{--}\cdot 2$ inch long; stipules exceeding the petiole, setaceous, toothed. Flowers pink, appearing before or with the leaves, 1-3 together on puberulous pedicels $\cdot 1$ inch long. Calyx-tube cylindric, $\cdot 3$ inch long, minutely puberulous; lobes one-fourth the length of the tube, pubescent without, tomentose within. Petals obovate, $\cdot 2$ inch long. Stamens about 25, inserted at different heights. Style exceeding the stamens; ovary glabrous. Drupe $\cdot 3$ inch long, ovoid, nearly dry, stone smooth.

Himalaya 9-12,000 feet; Kunawar, not common. Occasionally 6 feet high, usually 1-2 feet. Flowers: May.

2. *PRUNUS PROSTRATA*, Labill. *Dec. Syr.* I (1791) t. 6.—A small deciduous shrub, twigs slender, densely pubescent when young. Leaves conduplicate in bud, 1 inch long, elliptic or ovate-oblong, not acuminate, rather thick, serrate, dark-green and glabrous above, densely white tomentose beneath; petiole $\cdot 1\text{--}\cdot 2$ inch long; stipules equalling the petiole, setaceous, glandular. Flowers pink, 1-3 together, subsessile or with pedicels $\cdot 15$ inch long. Calyx-tube cylindric, $\cdot 3$ inch long, pubescent; lobes one-third the length of the tube, tomentose within. Petals suborbicular, $\cdot 3$ inch long. Stamens about 25, inserted at different heights. Style not exceeding the stamens; ovary glabrous. Drupe $\cdot 3$ inch long, ovoid or subglobose, nearly dry, stone smooth.

Himalaya from Chamba westwards 6-10,000 feet; Pangi. Flowers in April. Not found in the outer ranges.

3. *PRUNUS CERASOIDES*, D. Don, *Prodr. Fl. Nep.* (1825) p. 239.—A moderate sized deciduous tree, bark smooth, peeling off in thin horizontal strips, twigs pendulous, glabrous. Leaves conduplicate in bud, 2-3 inches long, elliptic or ovate-lanceolate, acuminate, finely simply or doubly serrate with gland-tipped teeth, glabrous and shining above paler beneath; petiole $\cdot 5$ inch long, with 2-4 glands near the top; stipules shorter than the petiole, glandular-fimbriate. Flowers pink, fading to white, appearing before or with the leaves in umbellate fascicles, peduncles 0 or very short, sometimes lengthening in fruit to 1 inch; pedicels slender, $\cdot 3\text{--}\cdot 6$ inch long. Calyx-tube narrowly campanulate, $\cdot 4$ inch long, glabrous; lobes ovate, acute, entire, $\cdot 15$ inch long. Petals $\cdot 5$ inch long, obovate. Stamens inserted at different heights. Ovary glabrous; style as long as the stamens; stigma sometimes 3-lobed. Fruit ovoid, $\cdot 5\text{--}\cdot 7$ inch

long, red or yellow, supported by the base of the calyx-tube, stone rugose and furrowed. *P. Puddum*, Roxb. ex Wall. Pl. As. Rar. II (1831) p. 37, t. 143. Brandis Ind. Trees, fig. 121. Vern. *Paja*.

Himalaya from the Indus eastwards 2-6,000 feet. Common near Palampur in Kangra. In Hazara large specimens are rare and only found near cultivation, seedlings are occasionally found in the forest but do not reach any size. In the Punjab this tree is probably introduced and self-sown, it also spreads by root-suckers. The tree is remarkable in shedding its foliage soon after the rains, it is handsome when in flower and worthy of cultivation for ornament. Flowers : October—November.

4. *PRUNUS PERSICA*, Stokes, *Bot. Mat. Med.* III (1812) p. 100.—A large deciduous shrub or small tree, twigs glabrous. Leaves conduplicate in bud, 2·5-4 inches long, lanceolate, ovate-lanceolate or lanceolate-oblong, acuminate, usually hairy on the midrib beneath when young, serrate ; petiole shorter than the greatest width of the leaf, glandular or not ; stipules subulate, fimbriate. Flowers pink, usually before, sometimes with the leaves, sessile or shortly pedicelled, mostly solitary on the previous year's wood. Calyx-tube campanulate, ·15 inch long, lobes woolly, equalling or exceeding the tube. Petals obovate, ·8 inch long. Stamens inserted at the mouth of the calyx-tube. Ovary and style hairy. Drupe downy, succulent, stone deeply furrowed. *Peach*. Vern. *Aru*.

Himalaya, completely naturalized in many places, especially in the Kilba Range Forests, Bashafr. The peach is cultivated from the plains to 10,000 feet in the hills. The numerous varieties are propagated by budding. A double-flowered variety is an ornamental garden plant. Flowers from January to May according to elevation. Fruit : May—October.

5. *PRUNUS ARMENIACA*, Linn. *Sp. Pl.* (1753) p. 474.—A medium-sized deciduous tree, twigs glabrous. Leaves convolute in bud, 2-3 by 1·5-2 inches, broadly ovate, acuminate, crenate-glandular, hairy on the nerves beneath when young, sometimes sparsely hispid above, when mature glabrous except for the axils of the nerves beneath ; petiole about 1 inch long, glandular ; stipules lanceolate, glandular on the margins. Flowers pinkish at first then white, appearing before the leaves, solitary or fascicled ; pedicels very short. Calyx-tube campanulate, puberulous, ·2 inch long ; lobes rounded, pubescent, half the length of the tube. Petals suborbicular, ·3-·5 inch long. Stamens inserted at the mouth of the calyx-tube. Ovary and base of the style hairy. Drupe downy or glabrous, yellow tinged with red, stone smooth with a thickened sulcate margin. *Apricot*. Vern. *Hári, sári, chuli*.

Himalaya to 12,000 feet, cultivated and occasionally self-sown, not naturalized. Planted sometimes in the plains but does not fruit well. The apricot is the commonest fruit tree in the Punjab Himalaya and the fruit is an important article of food both fresh and dried. The quality compared with European

apricots is bad and efforts to improve it have not proved successful as imported varieties do not fruit well. The tree is grown from seed which accounts for the inferior quality of the fruit and it could be greatly improved by selecting and grafting local varieties, the fruit of some forms being much superior to the general average. Flowers : January—May according to elevation. Fruit : June—September.

6. *PRUNUS CORNUTA*, Wall. Cat. (1828) No. 716.—A medium-sized deciduous tree, twigs glabrous or very finely pubescent. Leaves conduplicate in bud, 4-6 inches long, oblong-lanceolate or oblong-ovate, acuminate, base cordate or rounded, closely serrate, puberulous on the nerves above, glaucescent beneath with red midrib and main lateral nerves bearded in the axils ; petiole 1-1.5 inches long, red, usually with a pair of glands near the top ; stipules .5-.8 inch long, linear, fimbriate. Flowers white, in terminal or axillary drooping racemes 4-6 inches long, rachis and pedicels pubescent or nearly glabrous, the latter about .2 inch long. Calyx-tube hemispheric ; lobes small, rounded, toothed. Petals .15 inch long, orbicular, concave. Stamens shorter than the petals, inserted on an annular disk. Ovary and style glabrous. Drupe globose, .4 inch diameter, red or nearly black when ripe, stone thick, rugose. *P. Padus*, Linn. in Fl. Brit. Ind. The *Bird-Cherry*. Vern. *Kálakát* (Haz. Rp.), *Jámun*.

Himalaya from 4-10,000 feet. Common in deciduous forest. Trans-Indus. A useful tree in forests worked for firewood as it coppices well and regenerates to a certain extent by root-suckers. The wood is good but very little used. Growth in diameter rather slow and the tree is not usually more than 5-6 feet in girth. Flowers : April—June. The ovary is frequently attacked by an insect which causes it to grow out into a horn-like curved excrescence whence the specific name.

PRUNUS CERASUS, Linn.—*The Wild Cherry*.—A deciduous shrub or small tree producing numerous root-suckers. Leaves conduplicate in bud, rather firm, shining, obovate, acuminate, serrate, glands usually on the margin of the blade close to the insertion of the petiole. Flowers in fascicles of 2-5 on slender pedicels .8-1.6 inches long, flower-buds usually producing a few leaves below the flowers. Calyx-lobes usually toothed. Corolla white or pink. Fruit globose, light-red to nearly black, acid or sweet.

Cultivated in Abbottabad, etc.

PRUNUS AVIUM, Linn.—*The Sweet Cherry*.—Very similar to the above but larger and produces no root-suckers. Leaves flaccid, more coarsely serrate ; petiole with two glands near the top. Flower-buds not bearing leaves but with rather larger reflexed bud-scales. Calyx-lobes usually entire. Fruit nearly black, sweet, on peduncles up to 2 inches long.

Cultivated in the hills.

PRUNUS CERASIFERA, Ehr. Most of the plums cultivated in North-West India appear to belong to this species. Syn. *P. divaricata*, Ledeb. Vern. *Alúcha*, *Alá Bokhára*. The copper plum *P. cerasifera*, var. *Pissardi*, has also been introduced. It is grown for its deep reddish-purple foliage.

PRUNUS AMYGDALUS, Baillon.—*The Almond*.—Very similar to the peach. Petiole longer than the greatest width of the leaf. Flowers white tinged with pink, mostly paired. Fruit with a dry pericarp, stone with shallow wrinkles and minute pores. Vern. *Badám*.

Cultivated for its seeds, but not nearly so frequently as the peach and not naturalized.

2. PRINSEPIA, Royle.

(In honor of James Prinsep, formerly Secretary of the Asiatic Society, Bengal. **DISTRIB.** Species only the following ; Himalayan.)

PRINSEPIA UTILIS, *Royle, Illustr. Bot. Himal.* (1839) p. 206, t. 38, fig. 1.—A deciduous shrub, branches green, armed with stouts axillary thorns, the youngest shoots only pubescent, thorns often 1·5 inches long and leaf-bearing. Leaves 1-3 inches long, lanceolate, narrowed at both ends, minutely serrate, coriaceous, glabrous ; petiole ·2-·5 inch long ; stipules ·2 inch long, linear, caducous. Flowers ·3-·4 inch across, white, in short axillary racemes ; pedicels ·2-·5 inch long ; bracts linear or ovate, small. Calyx cup-shaped, persistent ; lobes 5, unequal, orbicular, imbricate in bud, reflexed after flowering. Petals 5, orbicular, shortly clawed. Stamens numerous, many-seriate, inserted on the mouth of the calyx-tube ; filaments short ; anther-cells unequal, separated by the broad connective. Carpel 1, sessile at the base of the calyx-tube ; style short, thick ; ovules 2, collateral. Drupe ·5-·7 inch long, oblong-cylindric, fleshy, purple when ripe, the style scar sub-basal, endocarp coriaceous, smooth, seed 1. *Vern. Békhal.*

Himalaya from the Indus eastwards, 2-9,000 feet. The seeds yield an oil used for burning. Flowers : April—May and again in October—November.

3. RUBUS, Linn.

(The Latin name for the bramble, derived from *ruber*, red ; referring to the color of the fruit in some species.)

Creeping herbs or erect or sarmentose shrubs, nearly always prickly. Leaves alternate, simple or compound, deciduous or evergreen, stipules free or adnate to the petiole. Flowers white, pink or purple, rarely yellow, in terminal and axillary corymbose panicles, rarely solitary. Calyx-tube broad, lobes 5, persistent. Petals 5, rarely 0. Stamens numerous. Carpels usually numerous ; style subterminal ; ovules 2, collateral, pendulous. Fruit of many usually united drupelets seated on a dry or spongy, conical or cylindric receptacle, red, yellow or black, rarely green or white, often edible. **DISTRIB.** Throughout the globe except in the driest and hottest regions, rare in the Southern Hemisphere. Species about 180-200 but as most of them are variable and some extremely so, over 1,500 so-called species have been described for Europe alone.

In addition to the species described below *R. saxatilis*, *Linn.* a herbaceous plant with 3-foliate leaves found at about 10,000 feet from Kashmir to Kumaon occurs in Pangt.

Leaves simple	...	...	...	1. <i>R. paniculatus.</i>
Leaves compound.				

I. Leaflets usually 3.

A. Flowers white.

1. Leaflets green beneath.

- | | |
|------------------------------|---------------------------|
| Stems tomentose, bristly ... | 2. <i>R. ellipticus</i> . |
| Stems glabrous, no bristles | 3. <i>R. macilentus</i> . |

2. Leaflets white beneath.

- | | |
|--|--------------------------|
| Stems bristly and glandular | 4. <i>R. purpureus</i> . |
| Stems not bristly, with a waxy bloom ... | 5. <i>R. biflorus</i> . |

B. Flowers pink.

Leaflets grey beneath, twigs very tomentose; fruit black ...

6. *R. fruticosus*.

Leaflets green or white beneath, twigs usually glabrous; fruit red ...

7. *R. niveus*.

II. Leaflets usually 5-7.

Leaflets green beneath ...

8. *R. pungens*.

Leaflets grey or white-tomentose beneath ...

9. *R. lasiocarpus*.

(In using the above table normal leaves on flowering shoots should be taken, not leaves on suckers or at the tips of flowering shoots.)

1. *RUBUS PANICULATUS*, *Smith, in Rees Cyclop.* XXX (1819) n. 41.—A large rambling shrub, branches often dark purplish-brown, twigs round, densely white-tomentose, prickles scanty, small, hooked and flattened, glands and bristles 0. Leaves simple, 3-5 inches long, ovate-cordate, long or shortly acuminate, obscurely 3-5-lobed or not, 3-5-nerved, toothed, upper surface clothed when young with deciduous tomentum, lower surface velvety with short dense white tomentum; petioles .7-2 inches long, white-tomentose, usually with a few prickles; stipules small, lacinate. Flowers white, .8 inch across the sepals, in loose terminal panicles, lower branches sometimes in the axils of the upper leaves; pedicels .2-1 inch long. Calyx tomentose and silky; lobes .3-.4 inch long, ovate, caudate, acuminate, erect or reflexed in fruit. Petals shorter than the calyx-lobes. Fruit .5 inch diameter, black, drupelets large, succulent, glabrous, receptacle villous.

Himalaya 3-6,000 feet, Rawalpindi, Chamba and Simla; not common. Flowers: April-June, fruit edible.

2. *RUBUS ELLIPTICUS*, *Smith, in Rees Cyclop.* XXX (1819) n. 16.—A large shrub with trailing branches, twigs tomentose, glands scanty, bristles numerous rusty-brown; prickles short, stout, conical, slightly curved on the branches hooked on the petioles and midribs. Leaves 2-8 inches long; petioles stout, tomentose, not channelled, bristly; stipules .1-.3 inch long, subulate. Leaflets 3, the lateral 1-3 inches long, shortly petiolulate, the terminal larger; all elliptic or orbicular-obovate, retuse or abruptly acute, hairy on the nerves

above and sparsely hairy on the surface, pale and tomentose beneath, thick, coriaceous, closely and finely toothed, nerves sunk on the upper surface, prominent beneath. Flowers white, .3-.5 inch across, in dense axillary and terminal panicles; pedicels .2-.4 inch long, tomentose. Calyx tomentose within and without; lobes .25 inch long, ovate, mucronate, erect in fruit. Petals longer than the calyx, obovate. Fruit .5 inch across, yellow, glabrous, drupelets numerous, receptacle conical, villous. Vern. *Alke, garacha* (Haz.).

Himalaya and Sub-Himalayan tract ascending to 7,000 feet from the Indus eastwards; common. Usually in open forest undergrowth at about 4,000 feet. Flowers: February—April. The fruit is the best in flavor of the species mentioned.

3. *RUBUS MACILENTUS*, *Camb. in Jacq. Voy. Bot.* (1844) p. 49, t. 60.—A suberect or trailing shrub, stems and twigs glabrous, shining, reddish-brown, angular; prickles much flattened from broad bases, curved or nearly straight, extending to the leaves, glands and bristles 0. Leaves 1.5-6 inches long; petiole channelled, glabrous or nearly so; stipules .2 inch long, linear or setaceous. Leaflets 3, rarely 1, the lateral .5-2 inches long, subsessile, ovate or ovate-lanceolate, the larger ones acuminate; the terminal usually acuminate from a rounded or cordate base; all thin, membranous, bright-green above, paler beneath, glabrous or nearly so. Flowers white, .3-.8 inch across, on short lateral leafy shoots, solitary or in clusters of 2-3, axillary or terminal; pedicels about .5 inch long, pubescent or glabrous, thickened upwards. Calyx pubescent without, tomentose within, tube very short; lobes caudate-acuminate. Petals obovate, slightly exceeding the sepals. Fruit .5 inch across, orange, drupelets many, glabrous, receptacle columnar, pubescent.

Outer Himalaya from the Indus eastwards 5-9,000 feet. Flowers: April—June; fruit edible. In moist forest undergrowth, sometimes gregarious.

4. *RUBUS PURPUREUS*, *Bunge, Enum. Plant. Chin. Bor.* (1832) p. 24.—A small suberect shrub, twigs round with loose papery bark, pale straw-colored, brown or purplish, covered often densely with straight slender prickles and gland-tipped bristles which extend to the petioles, inflorescence and calyx; prickles sometimes with swollen bases always slender and frequently bristle-like. Leaves 3-7 inches long; petiole stout, tomentose colored like the stem; stipules .1-.4 inch long, setaceous, bristly or glandular. Leaflets 3, rarely 5, the lateral 1.5-3.5 inches long, sessile, oblique, ovate, the terminal usually cordate; all coarsely simply or doubly serrate, glabrous above, white-tomentose beneath. Flowers white, .5-1 inch across the sepals, the lower axillary solitary, the upper in cymes

2-3 inches long ; pedicels usually about 1 inch long. Calyx pubescent, bristly ; lobes ovate-lanceolate, long-acuminate, glandular, .4 inch long. Petals shorter than the calyx, obovate. Fruit .5 inch across, red, supported at the base by the erect calyx-lobes, drupelets many, tomentose.

Inner Himalaya ; Kagar Valley on open ground near Lulu Sar, 11,000 feet ; Pangri, 8-9,000 feet ; Kunawar, 10-12,500 feet. Flowers : June—September. The above plant is *R. purpureus* of the Flora Brit. Ind. which according to Focke, Engl. Bot. Jahrbuch. XXIX, p. 398, is not Bunge's plant.

5. *RUBUS BIFLORUS*, *Buch-Ham. ex Sm. in Rees Cyclop.* XXX (1819) n. 9.—A large rambling shrub, branches purple with a white waxy bloom, young twigs pale-brown, glabrous or tomentose, prickles stout from a broad base, straight on the branches curved on young shoots and petioles, bristles and glands rarely present. Leaves 2-9 inches long ; petiole stout, glabrous or tomentose, faintly grooved ; stipules .2 inch long, linear. Leaflets (1-) 3 (-5), the lateral 1-2.5 inches long, sessile, ovate, the terminal broader, often cordate and 3-lobed ; all nearly glabrous above, white-tomentose beneath, inciso-serrate. Flowers white, .5-1 inch across, axillary, solitary or in few-flowered umbelliform cymes ; pedicels slender, usually glabrous, sometimes prickly, .5-1.5 inches long. Calyx glabrous without or tomentose on both sides, tube short ; lobes broadly ovate, abruptly short-acuminate, .25-.4 inch long. Petals broadly obovate, equalling or exceeding the calyx. Fruit .6-.7 inch across, orange or yellow, drupelets many, glabrous, receptacle columnar, villous, calyx-lobes spreading or suberect.

Himalaya 7-9,000 feet, fairly common, from the Indus eastwards. Flowers : April—June. Fruit edible.

6. *RUBUS FRUTICOSUS*, *Linn. Sp. Pl.* (1753) p. 493.—A suberect rambling shrub, twigs angular, tomentose ; prickles stout, recurved, extending to the petioles and inflorescence, glands and bristles 0. Leaves 2-6 inches long ; petiole stout, tomentose, not channelled ; stipules .2 inch long, subulate, velvety. Leaflets usually 3, often 1 towards the tips of the shoots, sometimes 5 towards the base, either pinnately or pedately arranged, the lateral 1-2 inches long, shortly petiolulate, oblique, ovate, elliptic or obovate, the terminal orbicular or obovate ; all rather thick, minutely pubescent above, grey beneath with dense short tomentum, simply or doubly serrate, nerves prominent beneath. Flowers pink, .3-.7 inch across, in terminal panicles ; pedicels .3-.7 inch long, velvety ; bracts persistent, linear, velvety, often bi- or tri-fid. Calyx velvety, tube short ; lobes .25 inch long, reflexed in fruit. Petals obovate, exceeding the sepals. Fruit .3 inch diameter, black, glabrous, slightly succulent, drupelets many ; receptacle deciduous.

Himalaya from the Jhelum westwards in rather hot dry places 2-3,000 feet. Salt Range. Common in Hazara in hedges, etc., especially at 3-4,000 feet. Flowers: May—September. This is *Rubus discolor*, Weihe & Nees.

7. *RUBUS NIVEUS*, Wall. Cat. (1828) No. 734.—A large rambling shrub, twigs sometimes purplish, glabrous or tomentose, usually without bristles or glands (sometimes glandular); prickles few or many, recurved from a stout base, small, extending to the petioles and sometimes to the inflorescence. Leaves 3-10 inches long; petiole glabrous or tomentose, channelled or not; stipules linear, .2-.8 inch long. Leaflets 3, rarely 5, the lateral 1-4 inches long, sessile or with petiolules up to .4 inch long, usually ovate; the terminal often cordate and lobed; all sharply simply or doubly serrate, usually hairy on the nerves and sparsely hairy on the upper surface, green and glabrescent beneath (*R. concolor*, Wall.) or more usually white-tomentose beneath, nerves prominent on the lower surface. Flowers pink, .3-1 inch across, the lower axillary, often solitary, the upper often forming a terminal raceme; pedicels .1-1 inch long, tomentose, bracts linear. Calyx densely clothed with grey or brown silky hairs, tube short; lobes ovate-lanceolate, acuminate, usually exceeding the petals, .2-.4 inch long, spreading or reflexed in fruit. Fruit red, .5 inch across, drupelets numerous, hairy.

Himalaya 6-10,000 feet. Trans-Indus to Bhotan, common. Flowers: May—July. An exceedingly variable plant; some of the 5-foliate forms look like hybrids between *niveus* and *lasiocarpus*. The name of this plant will sooner or later have to be changed to *R. gracilis*, Roxb. Hort. Beng. (1814), p. 39.

8. *RUBUS PUNGENS*, Camb. in Jacq. Voy. Bot. (1844) p. 48, t. 59.—A shrub with long arching branches, twigs round, hairy only when young, dull-brown, armed; prickles usually scattered bristle-like, straight on the older twigs and calyx, curved on young shoots and pedicels, sometimes glandular. Leaves 2-7 inches long; petiole slender, channelled, pubescent; stipules .2 inch long, lanceolate or setaceous. Leaflets (3-) 5-7, the lateral .5-2 inches long, ovate, sessile, the terminal broader; all thin, membranous, green on both sides but paler beneath, clothed with very fine adpressed hairs above and hairy on the nerves beneath, inciso-serrate or faintly lobed. Flowers white, .8 inch across, on stout leafy side shoots, solitary or 2-3 together, axillary and terminal; pedicels hairy, 1-2 inches long. Calyx tomentose, prickly; lobes ovate, caudate, .4-.5 inch long. Petals spatulate, longer than the sepals. Fruit .5 inch across, drupelets many, rather large, pubescent, receptacle conical, pubescent, calyx-lobes spreading.

Hazara District in Kagan and Siran Valleys 7-10,000 feet, in shady places. Flowers: May—June, sometimes double. Distrib. Trans-Indus, Kashmir.

9. *RUBUS LASIOCARPUS*, *Smith, in Rees Cyclop.* XXX (1819) n. 6.—A large rambling shrub, branches often rooting at the tips, twigs hairy when young becoming glabrous, purple and pruinose, eglandular; prickles scattered, stout, nearly straight on the older branches, curved on young shoots and leaves. Leaves up to 8 inches long; petiole channelled, glabrous or tomentose; stipules linear, .2-.3 inch long. Leaflets (3-) 5-7 (-11), the lateral sessile, up to 2 inches long, usually lanceolate, the terminal often broadly ovate, imperfectly divided, lobed or not; all sharply simply or doubly serrate, when mature glabrous above, white or grey-tomentose beneath, lateral nerves impressed above, prominent beneath, straight and parallel. Flowers dark-pink, .3-.6 inch across, in axillary and terminal often paniced corymbs; pedicels tomentose .3-.6 inch long, bracts linear. Calyx grey-tomentose, tube short; lobes lanceolate, acuminate, exceeding the petals, .2 inch long, spreading in fruit. Fruit black, .3-.5 inch across, drupelets numerous, hoary, receptacle columnar, villous.

Himalaya 4-10,000 feet. Common. Trans-Indus to Bhotan. Flowers: March—May. *Rubus foliolosus*, Don, is a prostrate form found in Chamba and Simla. This plant is sometimes difficult to distinguish from *R. niveus*, Wall., which has as a rule 3 leaflets, larger flowers and a silky tomentose calyx.

RUBUS NUTANS, *Wall.*—Stems prostrate, slender, twigs, petioles and peduncles clothed with spreading brown hairs, prickles and glands 0. Leaves trifoliate, petiole up to 4 inches long; stipules large, broadly ovate or oblong; terminal leaflet rhomboid or suborbicular, the lateral oblique, petiolulate; all thin, membranous, green on both sides, toothed and lobulate, glabrescent above, clothed with stiff hairs on the nerves beneath. Flowers white, usually axillary and solitary, 1.5 inches across. Calyx-lobes .5-.7 inch long, the outer pinnatifid towards the caudate-acuminate tips. Fruit red.

Indigenous to Kumaon and Garhwal. "Is common in Simla gardens and appears to be running wild. Introduced from Kumaon by Sir E. Buck, about 1883" (Collett, Fl. Siml., p. 159).

4. *SPIRÆA*, Linn.

(The classical name of *Spiræa Ulmaria*, the Meadow-Sweet.)

Shrubs or perennial herbs. Leaves alternate, simple or compound, with or without stipules. Flowers in axillary or terminal corymbs or cymes, white or pink. Calyx persistent, lobes 4-5. Petals 4-5. Stamens 20-60, free or connate below, usually inserted on the outer edge of an annular disk. Carpels usually 5, free or connate below. Seeds minute. Follicles usually dehiscent.

The genus as above defined is now usually divided up into a number of genera, the herbaceous members falling under *ULMARIA* and *ARUNCUS*, the shrubby species being separated as follows:—

SORBARIA.—Carpels opposite the calyx-lobes, connate. Leaves pinnate, with stipules. Species 7.

SPIRÆA.—Carpels alternating with the calyx-lobes, free. Leaves simple, without stipules. Species 60.

- | | | | |
|--|-----|-----|------------------------------|
| Leaves pinnate | ... | ... | 1. <i>S. Lindleyana</i> . |
| Leaves simple. | | | |
| Inflorescence corymbose, pedicels 1-flowered | | | 2. <i>S. hypericifolia</i> . |
| Inflorescence paniculate, lower branches cymose more than 1-flowered. | | | |
| Flowers bisexual. | | | |
| Calyx-tube within and ripe carpels villous | ... | ... | 3. <i>S. canescens</i> . |
| Calyx-tube within and ripe carpels glabrous or the latter with a few long hairs on the ventral suture. | | | |
| Pedicels villous | ... | | 4. <i>S. vacciniifolia</i> . |
| Pedicels slender, glabrous | ... | | 5. <i>S. gracilis</i> . |
| Flowers unisexual | ... | ... | 6. <i>S. bella</i> . |

1. **SPIRÆA LINDLEYANA**, *Wall. Cat.* (1828) No. 703.—A tall deciduous shrub. Leaves pinnate, 10-15 inches long; leaflets 13-23, 2-4 inches long, sessile, opposite, lanceolate or linear-oblong, base rounded, apex long-acuminate, margin sharply doubly serrate, glabrous above when mature, hairy or glabrous beneath, the terminal sometimes lobed or imperfectly divided; stipules .15-.2 inch long, linear, acute. Flowers white, .2-.25 inch across, in large terminal panicles. Calyx-lobes rounded. Petals orbicular. Stamens scarcely exceeding the petals. Disk conspicuous. Carpel 5, connate below, glabrous or pubescent, dehiscing dorsally when ripe. *S. sorbifolia*, *Linn.* in *Fl. Brit. Ind.*

Himalaya 4-11,000 feet, very common, from Hazara eastwards, also Trans-Indus. Flowers: June—August.

2. **SPIRÆA HYPERICIFOLIA**, *Linn. Sp. Pl.* (1753) p. 489.—A deciduous shrub with long grooved or ribbed branches; vigorous shoots densely grey tomentose, older twigs with reddish-brown bark ultimately peeling off in fibrous strips. Leaves .5-1.5 by .15-.5 inch, lanceolate, oblanceolate or elliptic, apex rounded or blunt, base narrowed into a short petiole, margin entire or faintly toothed towards the apex, thin, membranous, somewhat paler beneath; petiole up to .2 inch long. Flowers white, .3 inch across, in corymbs terminating short axillary shoots which are 2 inches long or reduced to a few leaves below the corymb; pedicels slender, glabrous, up to .4 inch long. Calyx glabrous outside; lobes tomentose within. Stamens about as long as the petals. Disk conspicuous. Ripe carpels more or less hairy, half immersed in the calyx-tube.

Himalaya 8-13,000 feet. Kagan and Siran valleys, Hazara. Flowers: July. **DISTRIB.** Kashmir and Baltistan.

3. **SPIRÆA CANESCENS**, *D. Don, Prodr. Fl. Nep.* (1825) p. 227.—A deciduous shrub with densely leafy arching branches

twigs densely pubescent when young, ribbed, greyish-brown or reddish-brown. Leaves up to .6 inch long, elliptic, obovate or oblanceolate, apex rounded, base usually cuneate, entire or 3-5-toothed at the tip, rather thick, more or less densely pubescent on both sides, paler beneath; petiole .1 inch long or less. Flowers white, .3 inch across, in cymose panicles terminating short axillary shoots 1-4 inches long, the lower branches cymose, the upper 1-flowered; pedicels and calyx densely hairy. Disk conspicuous. Ripe carpels villous, half-sunk in the calyx-tube.

Himalaya 5-9,000 feet, common, from Hazara eastwards. Flowers: May—July. A variable plant of which numerous varieties have been described but none appear to be well-marked.

4. *SPIRÆA VACCINIFOLIA*, *D. Don, Prodr. Fl. Nep.* (1825) p. 227.—A deciduous shrub, twigs densely tomentose when young becoming glabrous, brown. Leaves very variable, .5-1.5 inches long, ovate or elliptic-lanceolate, base narrowly or broadly cuneate, apex acute or obtuse, margin serrate, crenate or almost entire, glabrous above, pale beneath and glabrous or hairy on the nerves; petiole .15-.4 inch long. Flowers white, .2-.25 inch across, in dense-flowered branching cymes terminating short or long shoots; pedicels and calyx densely hairy. Stamens longer than the corolla. Disk conspicuous. Ripe carpels glabrous, half-sunk in the calyx-tube.

Himalaya 4-8,000 feet from Hazara eastwards, common, usually in rather hot exposed situations. Flowers: May—July. This is the most variable of the *Spiræas* and is best distinguished from *S. bella* (apart from the bisexual flowers) in having more densely hairy shoots and inflorescence, usually less deeply toothed leaves and smaller flowers.

5. *SPIRÆA GRACILIS*, *Maxim. in Act. Hort. Petrop.* VI (1879) p. 200.—A slender nearly glabrous shrub with terete branches. Leaves .7-1.3 inches long, elliptic-oblong or elliptic-ovate, rounded or subacute at both ends, entire or crenate-serrate, thin, membranous, glabrous, the nerves usually very obscure, pale beneath; petiole .1-.2 inch long, very slender. Flowers .2 inch across, white, bisexual, in broad panicles composed of simple corymbs terminating lateral shoots; pedicels slender, glabrous, up to .5 inch long. Calyx glabrous outside; lobes more or less villous on the margins. Stamens rather longer than the petals. Disk conspicuous. Ripe carpels glabrous, half-sunk in the calyx-tube. *S. parvifolia*, Bert. Fl. Brit. Ind. II, p. 326.

Himalaya 4-6,000 feet from Chamba westwards. Flowers: May—June. This plant is best recognized by its bisexual flowers and slender glabrous pedicels which characters it shares with *S. hypericifolia*, but in that species the twigs are distinctly ribbed or grooved. In the Punjab it appears to be confined to Chamba.

6. *SPIRÆA BELLA*, Sims, *Bot. Mag.* (1823) t. 2426.—A deciduous shrub with more or less erect habit; young twigs with long fine hairs (but not tomentose) pale-brown becoming dark-brown or grey, terete. Leaves 1-1.5 inches long, ovate, elliptic or lanceolate, coarsely serrate especially in the upper half, thin, membranous, pale and more or less glaucous beneath, glabrous above, glabrous or hairy on the nerves beneath; petiole .1-.3 inch long. Flowers unisexual, rather large, .3 inch across, in branched cymes terminating axillary shoots 2-8 inches long. Pedicels and calyx-tube hairy; calyx-lobes nearly glabrous. Stamens longer than the corolla except in the female flowers. Disk large and conspicuous. Ripe carpels glabrous except for a few hairs on the ventral suture, brown, shining, not sunk in the calyx-tube, styles spreading, as long as the valves.

Himalaya from the Indus eastwards 7-11,000 feet, common. Flowers: May—August, white or pink. According to Schneider III. *Handb. der Laubholzkunde*, 1, p. 471, the plant described in the *Fl. Brit. Ind.* as *S. bella* can be split up into *S. bella*, Sims, and *S. fastigiata*, Wall. The plant above described is the latter.

SPIRÆA CANTONIENSIS, Lour.—Flowers white, .4 inch across, in umbelliform corymbs; pedicels slender .5 inch long. *Spiræa corymbosa*, Roxb.

Commonly grown in gardens in the plains. Indigenous to China and Japan. Flowers: March—April.

SPIRÆA PRUNIFOLIA, Sieb. & Zucc.—Leaves about 1 inch long, elliptic, bright glossy green above, finely and sharply serrate. Flowers in sessile 3-7-flowered umbels, appearing from the branches when the plant is leafless. Corolla white, simple or double.

Indigenous to China. Sometimes cultivated both in the plains and at Abbottabad. Flowers: February—March.

5. *POTENTILLA*, Linn.

(From the Latin *potens*, powerful; referring to the reputed medicinal properties of some species).

Annual or perennial herbs, undershrubs or rarely small shrubs. Leaves deciduous, compound, trifoliate, digitate or pinnate; stipules adnate to the base of the petiole. Flowers white or yellow, rarely red, bisexual or inclined to be unisexual, 5-merous, solitary or in few-flowered cymes. Calyx persistent, 5-bracteolate, lobes valvate. Petals as many as calyx-lobes. Stamens 20-30. Disk annular or lining the calyx-tube. Carpels many on a small dry receptacle; style persistent or deciduous, ventral or terminal, ovule 1, pendulous. Fruit of many achenes on a dry receptacle. **DISTRIB.** Species about 200; temperate and frigid regions of the Northern Hemisphere, rare in the Southern.

In addition to the species described *P. ambigua*, Camb. occurs in the Punjab. It is a dwarf plant with woody rootstock, scarcely shrubby.

I. Flowers on woody shoots.

Leaves pinnate, leaflets not crowded;
flowers white; style very acute ... 1. *P. davurica*.

Leaves trifoliate or pinnate with crowded
leaflets; flowers yellow; stigma capitate.

Leaflets 5-7 except towards the ends of
the shoots ... 2. *P. fruticosa*.

Leaflets 3 ... 3. *P. rigida*.

II. Flowers on leafy herbaceous shoots.

Leaves pinnate; flowers white ... 4. *P. Salesoviana*.

Leaves trifoliate; flowers yellow ... 5. *P. eriocarpa*.

1. *POTENTILLA DAVURICA*, *Nestl. Comm. de Pot.* (1816) p. 31, t. I.—A dwarf shrub a few inches to 1 foot high, branches rather stout, densely covered with the remains of the stipules, bark ultimately peeling off in thin rolls. Leaves 1-1.5 inches long, crowded near the ends of the branches; stipules .2-.3 inch long, pale-brown, membranous. Leaflets 7-9, .4 by .2 inch, oblanceolate, very obscurely toothed towards the apex, densely silvery-silky on both sides, the uppermost pair with decurrent bases, the lowest pair smaller. Flowers .6 inch across, white, usually solitary; peduncles 1 inch long, silky. Bracteoles shorter and narrower than the calyx-lobes. Petals obovate, distinctly clawed, as long as the calyx-lobes. Anthers oblong, connective very narrow. Ovaries concealed by hairs; style long, narrowed to a sharp point; stigma very minute.

Hazara on rocks in the Murree Hills and in the Kagan and Siran Valleys 8-9,000 feet. Flowers: May June. Also in Kishtwar. This plant differs from the typical *P. davurica*, *Nestl.* in its silky leaves. It is perhaps identical with the silvery leaved forms which occur in Western China—*vide* E. M. Jesson, *Bot. Mag.* sub tab. 8637. From Jesson's var. *Veitchii* it differs in being dwarf with smaller flowers and in its acute style.

2. *POTENTILLA FRUTICOSA*, *Linn. Sp. Pl.* (1753) p. 495.—A shrub about 3 feet high, branches rather slender, bark ultimately peeling off in fibrous strips. Leaves 5-7-foliate or towards the ends of the shoots 3-foliate; the uppermost pair with broad decurrent bases, the two lowest pairs in 7-foliate leaves springing from the same point on the rachis; stipules pale-brown, membranous. Flowers yellow, solitary or in few-flowered cymes. Bracteoles as long as but narrower than the calyx-lobes. Petals orbicular, twice as long as the calyx-lobes. Anthers oval with broad connectives. Ovaries concealed by hairs; style not narrowed upwards; stigma capitate.

VAR. 1. FRUTICOSA proper.—Leaves 1-1.5 inches long, leaflets about .5-.7 inch long, sparsely hairy above, densely white-silky beneath. Flowers 1 inch across.

This form is nearest to the typical European form, it is found in Kashmir but I have seen no Punjab specimens.

VAR. 2. *ochreata*, *Lindl.*—Leaves .5 inch long, leaflets .2-.3 inch long, densely white-silky on both sides, margins revolute. Flowers .7 inch across, petals scarcely exceeding the calyx-lobes.

West Tibet, Ladak, Kunawar and Kumaon.

VAR. 3. *pumila*, *Hook. f.*—Very dwarf. Leaves up to .5 inch long, usually smaller, densely crowded; leaflets up to .2 inch long, silky. Flowers .3-.5 inch across, sessile or nearly so.

Gilgit, Baltistan, Lahoul, Pangi, 11-14,000 feet. Apparently a dwarf form from high elevations. Leaves not nearly so white and more densely crowded than in var. *ochreata*.

VAR. 4. *inglisii*, *Royle.*—Very dwarf and densely tufted. Leaves variable. Petiole and peduncle often elongate. Flowers .7-.9 inch across. Petals obcordate.

Himalaya 13-15,000 feet. Pangi, Kunawar. Apparently a distinct species.

3. *POTENTILLA RIGIDA*, *Wall. Cat.* (1828) No. 1009.—A shrub about 1 foot high, twigs very silky when young, often hidden by the overlapping stipules, old stems stout, the bark peeling off in papery rolls or fibrous strips. Leaves variable in size, .5-1 inch long; stipules .3-.5 inch long, brown, membranous. Leaflets 3, .4-1 by .15-.3 inch, elliptic-ob lanceolate, acute, densely adpressed silky on both sides, ultimately glabrescent beneath, the lateral with broad bases. Flowers .7-1.5 inches across, yellow, solitary, peduncles up to 1 inch long, villous. Bracteoles in pairs between the calyx-lobes, 10 in all, oblong, as long as the calyx-lobes, silky on both sides. Calyx-lobes cuspidate, silky without, glabrous within. Petals obovate, about twice as long as the calyx-lobes. Anthers oblong with prominent connectives. Ovaries concealed by hairs; style not narrowed upwards; stigma capitate.

Himalaya 9-13,000 feet; Simla, Hatto; Bashahr, Kunawar; Kumaon. Flowers: June—September. Easily recognized by its uniformly trifoliate leaves.

4. *POTENTILLA SALESOVIANA*, *Steph. in Mém. Soc. Nat. Mosc.* II (1809) p. 6, t. 3.—A shrub 3 feet high, twigs rather stout, little-branched, covered with the overlapping stipules. Leaves 2-4 inches long; stipules .5 inch long, membranous, with cuspidate tips. Leaflets 7-9, fewer on flowering shoots, about 1-2 by .5-.8 inch, the lower smaller, oblong, dark-green and glabrous above, pale and hairy on the nerves beneath, coarsely toothed, minutely petiolulate. Flowers 1-1.5 inches across, white, in few-flowered axillary and terminal cymes, borne on slender herbaceous leafy shoots which arise from

the tips of the stout woody twigs. Bracteoles linear, shorter than the calyx-lobes. Calyx tomentose, lobes acuminate. Petals obovate-oblong, exceeding the calyx-lobes. Anthers oval with broad connectives. Ovaries concealed by hairs; style ventral, very slender; stigma minute.

Himalaya 8-14,000 feet. Kashmir, Lahaul, Spiti, Western Tibet. Flowers sometimes pinkish.

5. *POTENTILLA ERIOCARPA*, Wall. Cat. (1828) No. 1012.—A small shrub, twigs stout, little-branched, 4-10 inches long, densely covered with the overlapping stipules. Leaves 3-foliate, common petiole usually 1-3 inches long, slender; stipules about .5 inch long, green, silky, acute. Leaflets .5-1.5 inches long, cuneate and entire in the lower half, deeply incised and toothed in the upper half, thin, membranous, glabrous, bright-green above, pale beneath. Flowers .8-1.2 inches across, yellow, solitary, axillary and terminal, borne on slender herbaceous leafy shoots which arise from the tips of the stout woody branches. Bracteoles very variable, linear or oblanceolate and acute, or broadly elliptic and toothed, as long as or longer or shorter than the calyx-lobes. Calyx-lobes ovate, cuspidate, slightly woolly at the tips within, otherwise glabrous. Petals orbicular-obcordate, exceeding the calyx-lobes. Anthers small, reniform. Ovaries concealed by silky hairs; style very slender, terminal; stigma minute.

Himalaya 9-15,000 feet. Kashmir, Pangi, Kulu, Kunawar, Garhwal, Kumaon to Sikkim. The plant is sometimes much reduced at high elevations. Flowers: July—September.

6. *ROSA*, Tourn.

(The classical name.)

Erect or climbing shrubs, usually armed with prickles. Leaves alternate, usually imparipinnate, stipules adnate to the petiole, leaflets serrate. Flowers terminal, solitary or corymbose, white, yellow or red. Calyx-tube globose or ovoid, contracted at the mouth; lobes 4-5, large. Petals 4-5 (in cultivation indefinite). Stamens numerous, inserted on the edge of the disk which lines the calyx-tube and nearly closes its mouth. Carpels numerous, at the bottom of the calyx-tube; styles free or connate; stigmas thickened; ovule 1. Fruit of coriaceous or bony achenes enclosed in the colored fleshy calyx-tube, the whole forming a false berry-like fruit. *DISTRIB.* Species about 100 but as they are all somewhat variable they have been much sub-divided; for Europe alone over 500 so-called species have been described. North Temperate Regions extending to India, Abyssinia and Mexico.

Erect shrubs.

Flowers 5-merous.

Leaves 2-8 inches long, leaflets 7-11 ... 1. *R. macrophylla*.

Leaves 5-2 inches long, leaflets 5-9 ... 2. *R. Webbiana*.

Flowers 4-merous ... 3. *R. sericea*.

Climbing shrub, flowers white ... 4. *R. moschata*.

1. *ROSA MACROPHYLLA*, Lindl. *Monogr. Ros.* (1820) p.35, t. 6.—An erect deciduous shrub, twigs glabrous, prickles variable in amount according to situation in which the plant is growing, when present straight or nearly so with broad bases, pale straw-colored. Leaves 2-8 inches long, petiole pubescent often prickly; stipules adnate to the petiole, glandular on the margins, broad, spreading. Leaflets 7-11, (.3-) .5-1 (-3) inch long, elliptic, usually nearly glabrous, pale beneath, finely simply serrate almost from the base. Flowers pink or white, solitary or corymbose; peduncles, pedicels and calyx more or less bristly-glandular; bracts large, .3-.5 inch long, ovate or lanceolate, glandular on the margins. Calyx-tube .5-1.5 inches long; lobes 1-2 inches long, exceeding the petals, tips dilated sometimes toothed. Corolla 1-2.5 inches across, petals 5, broadly obcordate. Styles free, scarcely exceeding the mouth of the calyx-tube. Fruit red, ovoid, up to 2 inches long, calyx-lobes erect, persistent.

Himalaya 6-11,000 feet, common, from the Indus eastwards and also Trans-Indus. Flowers: May-July. A common plant in forest undergrowth and then as a rule sparsely prickly.

2. *ROSA WEBBIANA*, Wall. *Cat.* (1828) No. 683.—A small deciduous shrub, twigs glabrous, prickles copious yellowish straight or slightly curved with broad dilated bases, large and small prickles often mixed on the same twigs. Leaves .5-2 (-4) inches long; petiole glabrous or pubescent, more or less glandular, often prickly; stipules adnate to the petiole, glandular on the margin, usually small. Leaflets 5-9, .2-1.3 inches long, suborbicular or obovate, glabrous or pubescent beneath, rather coarsely simply serrate except towards the base. Flowers pink, usually solitary; peduncles and calyx usually bristly-glandular; bracts variable, glandular on the margin. Calyx-tube .2-.3 inch long; lobes .5-1.5 inches long, usually with dilated tips. Corolla 1-3 inches across, petals 5, obcordate. Styles free, scarcely exceeding the mouth of the calyx-tube. Fruit red, ovoid or globose, .5-1.5 inches long, calyx-lobes persistent, reflexed after flowering, ultimately erect.

Inner dry Himalaya 5-13,000 feet, common in Kagan, Pangi and Bashahr. Flowers: June-August. Difficult to distinguish from some forms of *R. macrophylla*.

3. *ROSA SERICEA*, *Lindl. Monogr. Ros.* (1820) p. 105, t. 12.—A small deciduous shrub, twigs glabrous often unarmed, rarely bristly, prickles when present broad, flattened, straight, brown or sometimes nearly round in section. Leaves 1-3 inches long; petiole pubescent, rarely prickly; stipules adnate to the petiole, apiculate, usually not glandular. Leaflets 7-9, .5-1 inch long, usually oblong, toothed only towards the blunt apex, usually glabrous above and silky on the midrib beneath, rarely villous on both surfaces. Flowers white or pale yellow, solitary, ebracteate; peduncle and calyx-tube usually sticky, seldom glandular-bristly. Calyx-tube .2 inch long; lobes 4, long-pointed, pubescent. Corolla 2-2.5 inches across, petals 4. Styles free, villous below, much exceeding the mouth of the calyx-tube. Fruit .4-.6 inch long, red, globose or pyriform, calyx-lobes persistent, erect.

Himalaya 7-10,000 feet from Chamba eastwards, common in Bashahr. Flowers: May—July.

4. *ROSA MOSCHATA*, *J. Herrmann, Diss. de Rosa* (1762) p. 15.—large deciduous climber, twigs glabrous, prickles recurved brown. Leaves 2-6 inches long; petioles pubescent, usually prickly; stipules adnate to the petiole, narrow, glandular. Leaflets 5-9, 1-3 inches long, ovate or ovate-lanceolate, acute or acuminate, glabrous above, puberulous beneath, serrate. Flowers in terminal compound corymbs, peduncles and pedicels grey-pubescent, not prickly or bristly, bracts lanceolate. Calyx-tube .2 inch long, lobes lanceolate, caudate-acuminate, entire or pinnatifid, reflexed in flower. Corolla white, 1-1.5 inches across, petals 5. Styles united into a column much exceeding the mouth of the calyx-tube. Fruit globose or ovoid, dark-brown, .3 inch diameter. Vern. *tarni*. (Rp.), *kuja*.

Himalaya 4-8,000 feet, common, from the Indus eastwards, also Trans-Indus. Flowers: April—June.

The cultivated double-flowered roses are hybrids derived from *R. gallica*, Linn. with *R. damascena*, Mill. *R. centifolia*, Linn. *R. turbinata*, Ait. and *R. alba*, Linn. In India the double-flowered roses (excluding modern introductions) are traced to *R. indica*, Linn. Apart from the hybrids the following are seen in cultivation:—

ROSA DAMASCENA, *Mill.*—An erect shrub armed with curved unequal sized prickles mixed with prickly and glandular bristles. Leaflets 3-7, usually 5 on flowering shoots, simply serrate. Flowers large, 5-10 together. Calyx reflexed after flowering, not persistent, outer segments pinnatifid. Fruit ovoid, red. *Portland Rose*.

Cultivated commonly in native gardens for its fragrant flowers which are usually pink and imperfectly double. It is also grown for rose-water and attar.

ROSA LÆVIGATA, *Mchx.*—An evergreen scandent shrub armed with curved prickles. Leaflets on flowering shoots 3, glabrous, dark-green and

shining above; stipules with free subulate deciduous tips. Flowers solitary, white, 2.5-3 inches across. Peduncle and calyx bristly-glandular. Calyx-lobes with dilated tips. Petals 5. Fruit bristly with persistent, erect or spreading calyx-lobes.

A native of China, not often seen in the Punjab plains but much cultivated in Abbottabad in hedges, &c., and when in flower perhaps the most conspicuous feature of the station. Locally called the *Mardan Rose*.

7. CYDONIA, Tourn.

(From Cydon, in Crete, where the tree grew in large numbers. DISTRIB. Species 3; South Europe, warm temperate Asia to Japan.)

CYDONIA VULGARIS, Pers. *Syn.* II (1807) p. 40.— large deciduous shrub, bark dark-brown, young shoots tomentose. Leaves simple, 2-4 by 1.5-3 inches, ovate or ovate-elliptic, base rounded or slightly cordate, entire, dark-green and glabrous above when mature, grey-tomentose beneath; petiole hairy, .4-.6 inch long; stipules .3 inch long, oblong, obtuse, glandular-serrate. Flowers 2 inches across, white or pinkish, solitary, axillary, appearing after the leaves, peduncles short. Calyx-tube clavate, tomentose; lobes .5 inch long, oblong-lanceolate, glandular-serrate, reflexed, longer than the calyx-tube, tomentose. Petals 5, contorted, claws short, woolly. Stamens 20, in one series. Ovary 5-celled; styles 5, connate and woolly below the middle; ovules many in each cell, 2-seriate. Fruit a pome, pyriform, ribbed, depressed at the apex, aromatic, firm, fleshy, clothed with grey or woolly tomentum, 5-celled; cells cartilaginous, many-seeded; seeds covered with mucilage. *Cydonia oblonga*, Mill. The *Quince*. Vern. *Bih*.

Probably indigenous to Persia and Turkistan. Cultivated in S. Europe from very early times. Cultivated in the plains and hills of the Punjab up to 5,500 feet, but rarely if ever self-sown. The fruit is used for making jam and jelly and is eaten cooked.

8. PYRUS, Linn.

(The Latin name for the Pear tree.)

Trees or shrubs, deciduous or rarely evergreen. Leaves simple or pinnate. Flowers in cymes or corymbs usually terminating dwarf side shoots, white, pink or red. Calyx-tube usually urceolate, lobes 5, persistent or deciduous. Petals 5, imbricate. Stamens 20 or more. Disk annular or lining the calyx-tube. Carpels 2-5, connate, adnate to the calyx-tube, styles free or connate below, ovules 2 in each cell. Fruit a pome, fleshy, 2-5-celled, cells with a cartilaginous or membranous often 2-valved endocarp. DISTRIB. Species about 50-60; North Temperate Regions.

I. Leaves simple.

A. Leaves glabrous or if tomentose not lobulate.

1. Styles shortly connate below;
fruit not gritty.

Leaves more or less tomentose
beneath; fruit large, 2-3 inches
diameter ... 1. *P. Malus*.

Leaves nearly glabrous; fruit
small not exceeding 1 inch
diameter ... 2. *P. baccata*.

2. Styles free; fruit gritty.

Leaves broadly ovate; fruit large,
3-4 inches diameter ... 3. *P. sinensis*.

Leaves ovate-lanceolate or
lanceolate; fruit small, 1 inch
diameter or less ... 4. *P. Pashia*.

B. Leaves lobulate and white tomen-
tose beneath ... 5. *P. lanata*.

II. Leaves pinnate.

Leaflets 19-25, tomentose beneath ... 6. *P. foliolosa*.

Leaflets 19-25, grey-pubescent beneath ... 6. *P. foliolosa*, var. *cash-
miriana*.

Leaflets 13-17, glabrous or nearly so ... 7. *P. Aucuparia*.

1. *PYRUS MALUS*, *Linn. Sp. Pl.* (1753) p. 479.—A small deciduous tree, twigs tomentose when young, 1 year old twigs still more or less hairy. Leaves 2-3 inches long, usually ovate or elliptic, acuminate, crenate or serrate, when mature hairy on the midrib above, more or less tomentose beneath; petiole 5-1.5 inches long, rather stout, tomentose; stipules up to .3 inch long, linear. Flowers pink, 1-2 inches across, in umbels or fascicles on short lateral leafy shoots; pedicels 1-1.5 inches long, tomentose. Calyx-tube campanulate, tomentose, lobes ovate, acute, rather longer than the tube, tomentose or sometimes glabrescent within. Petals with a distinct claw. Styles 5, shortly united below, woolly in the lower half of the free portion. Fruit globose, depressed at each end and tipped with the persistent calyx-lobes, 2-3 inches diameter. The *Apple*. *Vern. Seo*.

Cultivated and (according to Brandis) apparently wild between 5,000 and 9,000 feet. Cultivated from the plains to 11,400 feet in Ladak. The common Kashmir apple has a polished pale-yellow fruit tinged with red. It is woolly and insipid and usually eaten cooked by Europeans. This is *Malus pumila*, Mill. It makes an excellent dwarfing stock on which to graft the European Apples.

2. *PYRUS BACCATA*, *Linn. Mant.* (1767) p. 75.—A small deciduous tree with short bole and rounded crown, twigs hairy

when young, soon becoming glabrous. Leaves 1·5-3 inches long, usually elliptic, acute or acuminate, sometimes ovate or almost orbicular, crenate or serrate, when mature glabrous or pubescent on the main nerves beneath; petiole ·5-1·5 inches long, slender, glabrous or pubescent; stipules ·2 inch long, setaceous. Flowers white, 1-1·5 inches across, in umbels or fascicles on short lateral leafy shoots; pedicels 1-2 inches long, glabrous or with a few loose spreading hairs. Calyx-tube urceolate, ·2 inch long, glabrous or tomentose; lobes lanceolate, acute, as long as or slightly longer than the calyx-tube, glabrous or tomentose without, tomentose within. Petals concave, variable in length and breadth. Styles 3-5, united below into a short woolly or glabrous column. Fruit ·3-1 inch diameter, red, depressed at the base and apex, calyx-lobes deciduous. *The Siberian Crab.*

Himalaya 6-10,000 feet from Kashmir eastwards, Pangi, Kunawar. Apparently not found in the moist outer ranges. A variable plant, according to Hooker (Bot. Mag. sub t. 6112) the West Himalayan specimens usually have more or less pubescent pedicels, calyces and petioles but those from the dry region of Spiti are glabrous. Some fruiting specimens apparently ripe, have obovoid fruits.

3. *PYRUS SINENSIS*, Lindl. *Trans. Hort. Soc.* VI (1826) p. 396.—A moderate sized deciduous tree, twigs not spinescent, glabrous. Leaves up to 6 by 3·5 inches, broadly ovate, acuminate, glabrous when mature, when quite young more or less hairy especially on the margins, shining above, margin serrate, the teeth tipped with deciduous bristle-like points; petiole up to 2 inches long, deeply channelled above; stipules linear, ·2 inch long. Flowers white, 1·25 inches across, appearing with the leaves on dwarf side shoots, corymbose; pedicels about 1·5 inches long, rather thick, almost glabrous. Calyx-tube ·2 inch long, urceolate, glabrous or puberulous; lobes ovate, acute, tomentose within, shorter or longer than the calyx-tube. Petals suborbicular. Styles free, not woolly. Fruit variable, pyriform or globose, 3-4 inches diameter, yellow with rough brown specks. Vern. *Náspáti*.

Commonly cultivated in the plains and hills up to 6,000 feet. Flowers: March—April. This is the pear commonly cultivated by natives, it is known as the *Chinese* or *Sand Pear* from its gritty fruits which are edible only when cooked. It fruits freely in the plains whereas *P. communis* does not.

4. *PYRUS PASHIA*, Buch-Ham. ex D. Don, *Prodr. Fl. Nep.* (1825) p. 236.—A small or medium-sized deciduous tree, thorny when young, twigs woolly when quite young, soon becoming glabrous. Leaves on young plants pinnately 3-5-lobed, sharply serrate, more or less woolly beneath, on mature plants 2-4 inches long, lanceolate or ovate-lanceolate, acuminate, sometimes caudate, crenate, woolly when quite young, glabrous

and shining above, glabrescent beneath when mature, drying black; petiole slender, up to 1.5 inches long; stipules setaceous, .4 inch long, caducous. Flowers white, .8-1 inch across, in corymbs or umbels; pedicels .5-2 inches long, woolly. Calyx-tube .2 inch long, urceolate, glabrous or woolly; lobes ovate, acute, glabrous or woolly without, more or less woolly within. Petals .3 inch long, orbicular-obovate. Stamens 25-30. Styles 3-5, free, woolly below. Fruit globose, .5-1 inch diameter, depressed at the top, brown, rough with raised whitish specks, calyx-lobes ultimately completely deciduous. Vern. *Batangi* (Haz. Rp.), *Kainth* (Ka.), *Shagal* (Bash.).

Himalaya 2,500-8,000 feet. Common. Trans-Indus to Bhotan. Flowers: March—May, but a few trees are often seen in flower after the rains. The fruit is edible when half-decayed. The tree is common on open dry hillsides at the higher elevations and in forest undergrowth at lower levels. The wood is hard, but cracks and warps and is mainly used for fuel. *Pyrus kumaoni*, Dene. is according to Dr. Stapf (Bot. Mag. sub tab. 8256) a variety of *P. Pashia* with glabrous or nearly glabrous inflorescence and calyx (outside). As however "the amount and degree of persistence of the tomentum shows considerable variation" in a series of specimens it seems of little value maintaining the variety. *P. Jacquemontiana*, Dene. supposed to differ in having a smooth fruit has not since been collected nor does it appear to have been seen by any botanist since its author.

5. *PYRUS LANATA*, D. Don, *Prodr. Fl. Nep.* (1825) p. 237.—A small deciduous tree, twigs clothed when young with deciduous white wool becoming glabrous and shining, dark-brown. Leaves variable in size, simple, 3-6 inches long, sometimes smaller, broadly ovate or elliptic, loosely woolly above when quite young, glabrous except sometimes on the midrib when mature, white woolly beneath, margins lobulate and serrate, lateral nerves 8-12 pairs; petiole .2-1 inch long, stout, woolly; stipules .3 inch long, linear, caducous. Flowers white, about .5 inch across, in terminal or subterminal woolly corymbs. Calyx-tube turbinate, .15-.2 inch long; lobes lanceolate, acute, .1 inch long, woolly within. Petals obovate, glabrous, .25 inch long. Stamens 20, shorter than the petals. Styles 2-3, densely woolly almost to the top. Fruits .5-1.5 inches diameter, pyriform, crowned with the persistent calyx-lobes, yellowish-red, edible. Vern. *doda* (Haz.).

Himalaya 8-10,000 feet. Common. Trans-Indus eastwards to Kumaon. Flowers: April—May. A variety is found in Bashahr with the leaves glabrous except on the main nerves beneath and 5 styles.

6. *PYRUS FOLIOLOSA*, Wall. *Pl. As. Rar.* II (1831) p. 81, t. 189.—A small deciduous tree, twigs glabrescent. Leaves 4-8 inches long, petiole rusty-tomentose beneath, narrowly winged; stipules usually ovate-acuminate, foliaceous, sometimes with several cuspidate teeth. Leaflets (15-) 19-25, linear-oblong, up to 2 by .5 inch, dark-green above, pale and rusty-

tomentose on the midrib beneath, sharply serrate in the upper half with a prominent apiculate tip. Inflorescence about 2 inches long, rusty-tomentose, flowers greenish-white, about .3 inch across, mixed with rusty linear bracts. Calyx-tube hemispheric, .15 inch long, lobes triangular less than half the length of the tube. Petals orbicular-obovate, .1 inch long. Stamens about half as long as the petals. Styles short, thick, slightly woolly at the base, usually 5. Fruit small, ovoid or globose, .3 inch across, bluish-red when ripe. *P. ursina*, Wall. var. *Wenzigiana*, C. K. Schneider.

Himalaya 9-12,000 feet. Chamba State; Kunawar; Hattu and Chur Mts. Simla District. Flowers: May—June. Not common.

VAR. CASHMIRIANA (*sp. Hedl.*)—Leaflets 1-1.5 by .4-.5 inch, lanceolate, more coarsely toothed almost from the base; petiole and midrib of the leaflets more or less grey-hairy. Inflorescence 2-4 inches long, nearly glabrous, flowers pink or white, .4-.5 inch across. Calyx-tube .1 inch long, cup-shaped; lobes broadly triangular, half as long as the tube. Petals orbicular-obovate, .2 inch long. Stamens about half as long as the petals. Styles mostly 5, woolly at the base. Fruit globose, scarlet or white, .5 inch across. *P. ursina*, Wall. var. *typica*, C. K. Schneider.

Himalaya from the Indus eastwards, common, 7-12,000 feet. This plant has been referred sometimes to *P. foliolosa* and sometimes to *P. Aucuparia* between which species it is more or less intermediate. Smaller-leaved forms have been referred by various authorities to *P. microphylla*, Wall. There appears to be no absolute distinction between the members of this section (*P. foliolosa*, *microphylla* and *Aucuparia*) and there are numerous intermediates so that the classification of a range of specimens is a question on which no two persons are likely to agree.

7. PYRUS AUCUPARIA, *Gærtn. De Fruct.* II (1791) p. 45, t. 87.—A small deciduous tree, twigs glabrous or sparsely grey-hairy. Leaves 4-6 inches long; petiole glabrous, not winged; stipules small, linear-subulate. Leaflets 13-17, oblong-lanceolate, up to 2 by .5 inch, usually widest below the middle and narrowed in the upper portion, glabrous or very sparsely hairy at the base of the midrib beneath, serrate almost from the base. Inflorescence glabrous, 4-5 inches long, flowers white, .6-.8 inch across. Calyx-tube .1 inch long, cup-shaped; lobes broad, triangular, about as long as the tube. Petals obovate-orbicular, .25-.3 inch long. Stamens about half as long as the petals. Styles usually 5, very woolly at the base. Fruit dark-purple, with a glaucous bloom, .5 inch diameter.

Himalaya 10-12,000 feet. Flowers: July—August. I have seen no Punjab specimens which quite answer the above description which is based on specimens from Afghanistan, Baltistan and West Tibet. This plant differs considerably from the *P. Aucuparia* of Europe and according to Schneider should be referred to *P. thianshanica*, Rupr.

PYRUS COMMUNIS, Linn. *Sp. Pl.* 479. The *Pear* of Europe.—A deciduous tree with more or less pyramidal branches, often spinescent. Leaves up to 2·5 inches long, without bristle-pointed teeth, shortly abruptly acuminate or acute, petiole slender. Fruit usually more pyriform, paler in color, smoother and much less gritty than in *P. sinensis*.

Cultivated at Abbottabad, in Kulu, Bashahr, Simla, etc. Some varieties can be made to fruit in the plains, but it is hardly worth growing below 4,000 feet. Usually grafted on to *P. Pashia*.

9. CRATÆGUS, Linn.

(From the Greek, *kratos*, strength; referring to the wood.)

Shrubs or small trees, often thorny. Leaves usually deciduous, simple, lobed or pinnatifid, stipules deciduous. Flowers white or red, in terminal corymbose cymes, rarely solitary; bracts caducous. Calyx-tube urceolate or campanulate, mouth contracted; lobes 5, persistent or deciduous. Petals 5, inserted at the mouth of the calyx-tube, imbricate. Stamens usually many. Carpels 1-5, adnate to the calyx-tube; styles as many as carpels, free or more or less united; ovules 2 in each carpel. Fruit red, yellow or black, formed from the enlarged calyx-tube, containing a bony 1-5-celled stone or 1-5 bony, 1-(rarely 2-) seeded stones. **DISTRIB.** North temperate regions, chiefly American; species about 60. The American species are variable and between 1898 and 1906 about 550 so-called species have been described.

Leaves thin, deeply fid and toothed	...	1. <i>C. Oxyacantha</i> .
Leaves coriaceous, crenulate	...	2. <i>C. crenulata</i> .

1. *CRATÆGUS OXYACANTHA*, Linn. *Sp. Pl.* (1753) p. 477.—A shrub or small tree, deciduous, bark grey peeling off in long flakes, young shoots with scattered long hairs, branches often armed with straight axillary or terminal thorns. Leaves 1-2·5 inches long, often broader than long, pinnately irregularly 3-7-lobed, toothed, base truncate but abruptly narrowed into the petiole or cuneate, more or less clothed on both sides with long scattered hairs especially along the nerves, paler beneath, thin, membranous; petiole ·2-1 inch long, slender; stipules on vigorous shoots ·5 inch long, leaf-like, persistent, the upper falcate, acute, very oblique, toothed, the lower larger, orbicular, cut and toothed. Flowers ·5 inch across, white, in many-flowered terminal corymbose cymes, the lower branches axillary. Calyx-tube ·1 inch long, glabrous or hairy; lobes subacute, reflexed, as long as the tube. Petals orbicular, spreading. Styles 2-3, glabrous, free. Fruit globose-ovoid, ·4 inch long, scarlet, containing 2-3 more or less united, bony pyrenes. *The Hawthorn*. Vern. *bat-sangli* (Haz.)

Himalaya 4-9,000 feet. Hazara, Rawalpindi, Chamba, fairly common. Flowers: April—July. If *C. monogyna*, Jacq. is to be separated from

C. Oxyacantha the Himalayan plant should be referred to the former with which it agrees better in the leaves and calyx. The style in *C. monogyna* is however solitary.

2. *CRATÆGUS CRENULATA*, Roxb. *Hort. Beng.* (1814) p. 38.—A large evergreen thorny shrub, branches stiff, young shoots tomentose. Leaves 1-2·5 by ·3-·7 inch, linear-oblong or oblong-ob lanceolate, crenulate, coriaceous, shining above, paler beneath, glabrous, apex usually obtuse, base narrowed into a marginate and channelled petiole ·1-·4 inch long. Flowers ·2-·3 inch across, white, in many-flowered terminal corymbose cymes, the lower branches axillary. Calyx-tube ·1 inch long, hemispheric, glabrous; lobes obtuse, shorter than the tube. Petals orbicular, spreading. Carpels 5, free from one another and from the calyx-tube for one-third of their length in the upper part. Fruit ·2-·3 inch diameter, globose, vermilion when ripe, containing 5 separable pyrenes, the upper portions of which are free and protruded between the persistent calyx-lobes. *Pyracantha crenulata*, Roem.

Himalaya from the Beas eastwards, 5-8,000 feet, not common. Flowers : April—May.

10. COTONEASTER, Medik.

[From the Latin *Cotonia* (*Cydonia*), the Quince, and *aster* (*ad instar*) similar.]

Shrubs or small trees. Leaves quite entire, deciduous or evergreen; stipules setaceous, deciduous. Flowers small, white or pink, solitary or in cymes, usually terminating short lateral shoots. Calyx-tube turbinate or campanulate; lobes 5, short, persistent. Petals 5, orbicular, imbricate. Stamens usually 20, inserted round the top of the calyx-tube. Carpels 2-5, adnate wholly or by their backs only to the calyx-tube; ovules 2 in each carpel. Fruit a drupe, containing 2-5 bony 1-seeded stones. **DISTRIB.** Species about 20 (excluding numerous recently described Chinese species); temperate regions in the Northern Hemisphere.

ORTHOPETALUM.—Corolla erect in flower, flowers not opening widely, usually pink.

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|---|-----|-----|----------------------------|
| Leaves glabrous or nearly so | ... | ... | 1. <i>C. rosea</i> . |
| Leaves adpressed hairy, apex acute, greatest width below the middle | ... | ... | 2. <i>C. acuminata</i> . |
| Leaves tomentose beneath, usually less rounded at the apex | ... | ... | 3. <i>C. integerrima</i> . |

CHÆNOPETALUM.—Corolla spreading, flowers opening widely, usually white.

- | | | | | |
|--|-----|-----|-----|----------------------------|
| Leaves thick, evergreen, margins more or less recurved | ... | ... | ... | 4. <i>C. microphylla</i> . |
|--|-----|-----|-----|----------------------------|

Leaves deciduous, flat.

Mature leaves .8 inch long or less, densely tomentose beneath; cymes 2-5-flowered 5. *C. nummularia*.

Mature leaves up to 1.5 inches long, nearly glabrous beneath; cymes 5-10-flowered ... 6. *C. Lindleyi*.

Mature leaves 1.5-3 inches long; cymes many-flowered, usually branched ... 7. *C. bacillaris*.

As Hooker remarks the species are very variable and difficult of discrimination, it seems impossible to draw a sharp line between many of them.

1. *COTONEASTER ROSEA*, *Edgew. Trans. Linn. Soc. XX* (1851) p. 46.—An erect deciduous shrub, twigs light-brown very sparsely hairy when quite young. Leaves .5-2 by .3-1 inch, elliptic, thin, membranous, bright-green above pale and glaucous beneath, base rounded, apex rounded or bluntly pointed, mucronate, slightly hairy on the midrib above and ciliate when young, practically glabrous beneath; petiole .1-.25 inch long. Cymes loose, 3-10-flowered, .5-1 inch long, peduncle and pedicels usually glabrous. Calyx-tube and lobes usually quite glabrous outside. Petals pink. Stamens 15-20. Styles 2. Fruit bright red, frequently only one fruit from each inflorescence ripens.

Himalaya 8-11,000 feet. Hazara, in the Kagan Valley and at Thandiani; Pangi, Bashahr. *DISTRIB.* Afghanistan to Tibri-Garhwal. In the field *C. rosea* is easily recognised by its pink flowers and red fruits and scarcity of hairs in all its parts except inside the calyx, and occasionally on the inflorescence. Flowers: May-June.

2. *COTONEASTER ACUMINATA*, *Lindl. Trans. Linn. Soc. XIII* (1821) p. 101, t. 9.—An erect deciduous shrub up to 12 feet high, young twigs densely clothed with pale yellowish-grey bristly hairs, becoming glabrous and grey or purplish-brown. Leaves often crowded on arrested shoots, 1-2 by .3-1 inch, ovate or lanceolate, deep-green above, paler beneath, base rounded or broadly cuneate, tapering from somewhat below the middle to a long point, mucronate, hairy especially on the midrib beneath and with scattered adpressed hairs above, ciliate; petiole .2 inch long or less. Cymes 1-5-flowered, .5 inch long, peduncle and pedicels short, clothed as is also the calyx-tube with bristly hairs. Flowers .2 inch across, petals pink or white. Stamens 20. Styles 2 (-3). Fruit deep-scarlet with incurved calyx-lobes. Brandis, *Ind. Trees*, fig. 125.

Himalaya 5-12,000 feet. Simla common, Kulu. In Chamba and Hazara scarce, but a dwarf form occurs at 10-11,000 feet; it has broadly ovate leaves .5 inch long. Flowers: May-July.

3. *COTONEASTER INTEGERRIMA*, *Medik. Gesch. d. Bot.* (1793) p. 85.—An erect deciduous shrub, young twigs densely grey-hairy becoming glabrous and purplish-brown. Leave,

1-2 by .7-1 inch, broadly ovate or elliptic, usually rounded at both ends, mucronate, dull-green above, paler beneath, glabrous or hairy along the midrib above, ciliate, more or less grey-tomentose beneath; petiole .2-.3 inch long. Cymes 1-4-flowered, .5-.7 inch long, pedicels hairy. Calyx-tube and lobes glabrous or with a few long hairs. Stamens 20. Styles 2-4. Fruit red. *C. vulgaris*, Lindl.

Himalaya 7,500 to 12,000 feet. Hazara, Nathiagali. DISTRIB. Baltistan, Gilgit westwards to Europe. A specimen from Pangi in Herb. Dehra probably belongs to this species; it has leaves up to 3 inches by 1.8 inches. According to C. K. Schneider Illustr. Handb. der Laubholz. p. 748, *C. integerrima* does not occur in the Himalaya, but I find the Indian specimens agree well with those from the Altai Mountains and Europe. Flowers: May-June.

4. COTONEASTER MICROPHYLLA, Wall. in Lindl. Bot. Reg. (1827) t. 1113.—A low or prostrate rigid much-branched evergreen shrub, young twigs sparsely hairy becoming glabrous and purplish-brown. Leaves very variable in size, usually .3 inch long, oblong, obovate or elliptic, coriaceous, shining above nearly glabrous except on the depressed midrib, pale and more or less bristly-hairy beneath, margins recurved, ciliate, apex rounded, retuse or apiculate, base cuneate or rounded; petiole .1 inch long, or less. Flowers white, .3 inch across, 1-3 together, usually solitary. Calyx-tube and lobes densely hairy. Stamens 20. Styles 2. Fruit scarlet.

Himalaya 4-12,000 feet usually growing over rocks which it covers with a dense network of branches. Branches sometimes rooting. Flowers: May-June.

The following varieties are occasionally well-marked but appear to pass gradually into one another:—

VAR. BUXIFOLIA (sp. Wall. in Fl. Brit. Ind., ex parte).—Leaves larger up to .7 by .5 inch. Flowers larger, .5 inch across, usually 2-3 together; fruit .3 inch across. *C. rotundifolia*, Wall.

Chamba and Bashahr States, 4-9,000 feet.

VAR. THYMIFOLIA (sp. Baker in Fl. Brit. Ind.). Leaves smaller, cuneate-obovate or oblong. Flowers and fruit smaller.

DISTRIB. as for the type.

5. COTONEASTER NUMMULARIA, Fisch. et Mey. Ind. Sem. Ht. Petrop. II (1835) p. 31.—A straggling or prostrate deciduous shrub, twigs hairy when young becoming glabrous and purplish-brown. Leaves up to .8 inch long, orbicular or broadly elliptic, ultimately glabrous above, densely grey-tomentose beneath, rounded at both ends; petiole .1 inch long. Cymes very short, densely woolly-tomentose, 2-5-flowered. Calyx-tube and lobes woolly. Stamens 15. Styles 2. Fruit black. *C. racemiflora*, var. *Kotschyi*, C. K. Schneider, l. c., p. 754.

Himalaya 6-10,000 feet. Kunawar, Pangi, Hazara; also in Garhwal, Kashmir and Trans-Indus. A species of the dry inner valleys. Passes gradually into the following though usually quite distinct. Flowers: May—June.

6. *COTONEASTER LINDLEYI*, Steud. Nom. ed. 2, I (1841) p. 426.—A straggling or suberect deciduous shrub, twigs densely grey-tomentose when young, becoming glabrous and dark-brown. Leaves .5-1.5 inches long, orbicular or broadly obovate, glabrous above except when young, more or less tomentose beneath when young becoming almost glabrous when mature, dark-green above, pale beneath, apex rounded, usually retuse, mucronate, base rounded or broadly cuneate; petiole .15-.3 inch long. Cymes 5-10-flowered, about .7 inch across, woolly-tomentose. Calyx-tube and -lobes woolly. Petals white, Stamens 20. Styles 2. Fruit bluish-black with a glaucous bloom.

Himalaya 4,500-11,000 feet, common in the Kagan Valley, Hazara. DISTRIB. Kashmir, Afghanistan and Kumaon. The plant ordinarily met with in Hazara is distinguished from *C. nummularia* by its larger leaves which when mature are nearly glabrous beneath. Some forms of *C. bacillaris* closely approach *C. Lindleyi* differing in the larger looser and usually branched cymes. Flowers: May—June.

7. *COTONEASTER BACILLARIS*, Wall. in Lindl. Bot. Reg. (1829) ad t. 1229.—An erect deciduous shrub or small tree, young shoots tomentose or nearly glabrous, reddish-brown. Leaves variable, 1.5-3 inches long, lanceolate, ovate or obovate, quite glabrous or more or less woolly-tomentose beneath, usually distinctly narrowed into the petiole, tip acute or rounded, dark-green above, pale-green beneath; petiole up to .5 inch long. Cymes usually branched and many-flowered, 1-2 inches across. Calyx-tube and -lobes puberulous to woolly. Petals white. Stamens 20. Styles 2. Fruit bluish-black with a glaucous bloom. Vern. *luni* (Haz.), *rauns*, *riónsh*.

Himalaya Trans-Indus to Nepal, 4,000-10,000 feet. Salt Range. Very common and variable, several varieties have been described but they are not clearly marked. The wood is much used for walking sticks and makes excellent tent pegs. Flowers: May—June.

ERIOTRYA JAPONICA, Lindl.—A small evergreen tree, branches, leaves beneath and inflorescence densely softly woolly. Leaves 6-8 by 1.5-3 inches, narrowly oblanceolate, acuminate, remotely serrate, thick, coriaceous, nerves 12-15 pairs, prominent beneath, base narrowed into a very short stout woolly petiole; stipules .5 inch long, lanceolate, acuminate, subsistent. Flowers .5 inch across, white, fragrant, in terminal panicles 3-6 inches long. Ovary 2-5-celled; styles 5, connate and woolly below; ovules 2 in each cell. Fruit succulent, formed from the calyx-tube, 1-1.5 inches long, pyriform, yellow, endocarp very thin, seeds 2-5, large, angular. Vern. *Lokát*.

The Loquat, indigenous to Japan, cultivated for its fruits in the plains and Sub-Himalayan tract. The best varieties are propagated by inarching.

QUILLAJA SAPONARIA, Molina.—An evergreen tree. Leaves 1-1.5 inches long, elliptic, glabrous, shining above, with a few distant blunt teeth. Flowers

·5 inch across, 3-4 at the ends of short lateral shoots. Calyx 5-cleft, densely pubescent on both sides; lobes coriaceous, valvate. Petals 5, small, spatulate. Disk thick, fleshy, lining the calyx-tube and produced into 5 large lobes adnate to the calyx-lobes. Stamens 10, five inserted on the tips of the disk-lobes and five within the disk. Carpels 5, tomentose. Fruit of 5 oblong, coriaceous follicles ·5 inch long.

Indigenous to Chile. The bark is rich in saponin and is useful for dressing wool and silk. Cultivated in Abbottabad, does well and is ornamental.

KERRIA JAPONICA, DC.—A deciduous shrub. Leaves 1·5-2·5 inches long, ovate-lanceolate, coarsely doubly serrate, long-acuminate. Flowers yellow, about 1 inch across, double.

Indigenous to Japan. Cultivated in gardens.

XXXVIII. SAXIFRAGACEÆ.

Herbs, shrubs or trees. Leaves alternate or opposite, exstipulate or with stipules adnate to the base of the petioles. Flowers bisexual or sometimes unisexual by abortion, regular, usually 5-merous, sometimes 4-merous. Calyx-tube more or less adnate to the ovary, sometimes quite inferior; lobes imbricate or valvate. Petals as many as the calyx-lobes, rarely wanting, epigynous or perigynous, rarely subhypogynous, imbricate or valvate. Stamens obdiplostemonous, or as many as and alternating with the petals, rarely numerous. Ovary of 2 or 3-5 carpels, usually 2- or 3-5-celled with axile placentæ, less often 1-celled with parietal placentæ; styles as many as carpels, free or united almost to the summit; stigma capitate or lateral and subcapitate; ovules numerous. Fruit a capsule or berry. **DISTRIB.** A large family of cold and temperate regions of the world and of the mountains in the tropics, with a few genera of tropical trees.

Leaves opposite.

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|-----------------------------|-----|-----|--------------------------|
| A climbing shrub | ... | ... | 1. <i>Hydrangea</i> . |
| Erect shrubs. | | | |
| Stamens 10; hairs stellate | ... | ... | 2. <i>Deutzia</i> . |
| Stamens 20-40; hairs simple | ... | ... | 3. <i>Philadelphus</i> . |

Leaves alternate.

- | | | | |
|--|-----|-----|-------------------|
| Leaves 1-nerved; ovary almost wholly superior; fruit a capsule | ... | ... | 4. <i>Itea</i> . |
| Leaves 3-5-nerved; ovary inferior; fruit a berry | ... | ... | 5. <i>Ribes</i> . |

1. *HYDRANGEA*, Linn.

(From the Greek, *hudos*, water, and *ageion*, a vase or cup; referring to the cup-shaped capsule. **DISTRIB.** Species 33; from the Himalaya and Java to Japan, Eastern N. America and Western S. America.)

HYDRANGEA ALTISSIMA, Wall. *Tent. Fl. Nep.* (1826) t. 50.—A large deciduous shrub climbing by means of adventitious roots, bark of twigs smooth, shining, peeling off in papery rolls. Leaves opposite, 3-6 by 2-4 inches, ovate, acuminate, thin,

membranous, serrate, glabrous except in the axils of the nerves and sometimes along the main nerves; petiole 1-2 inches long, base semiamplexicaul, hairy; stipules 0. Flowers dimorphous, in terminal corymbose trichotomous cymes 5-6 inches across; some of the outer flowers sterile, apetalous, .8-1.2 inches across, with enlarged white, suborbicular or broadly elliptic, petaloid calyx-lobes; fertile flowers .1 inch across. Bracts, the lower 1.5 inches long, lanceolate, acuminate, bracteoles .1 inch long, linear, all caducous. Cyme-branches and pedicels pilose. Calyx-tube .07 inch long, adnate to the ovary, turbinate; lobes 4-5, small, triangular. Petals cohering in a calyptra, deciduous when the flowers open. Stamens 10-15. Ovary inferior; styles 2, diverging. Capsule .15 inch diameter, subhemispheric, dehiscent at the apex between the styles.

Himalaya 4-8,000 feet, from the Ravi eastwards, in moist shady places. Flowers: May-July. The sterile flowers are often not developed. The calyx-lobes appear to be always 4 in the sterile flowers but usually 5 in the fertile flowers. According to Clarke in Fl. Brit. Ind., II, p. 404, the stamens are 10 and *H. scandens*, Maxim. of Japan only differs by having 15 stamens and rather larger buds. The Himalayan specimens I have examined showed 12-15 stamens so that *H. altissima* is probably not specifically different from *H. scandens*.

HYDRANGEA HORTENSIA, Sieb.—A large shrub. Leaves about 5 by 2.5 inches, elliptic, acuminate, serrate, glabrous except along and in the axils of the nerves. Flowers in large cymes, all sterile, similar to the sterile flowers of *H. altissima*, pale-blue or rose.

Native of China and Japan. Often grown in gardens in the hills and as a pot plant in the plains. It is propagated by cuttings.

2. DEUTZIA, Thunb.

(In honor of Johann Deutz, a Dutch naturalist of the 18th century.)

Deciduous shrubs, usually clothed with unicellular stellate hairs. Leaves opposite, ovate or lanceolate, serrate, stipules 0. Flowers bisexual, white, axillary, solitary or corymbose. Calyx-tube campanulate, adnate to the ovary, thickened and hardened in fruit; lobes 5, valvate. Petals 5, valvate or imbricate. Stamens 10, rarely 12-15; filaments often with 2 teeth. Ovary 3-5-celled, inferior; styles 3-5, long, thickened towards the top; stigmas oblong; ovules numerous, axile. Capsule ovoid, truncate at the apex, splitting septically from below upwards into separate carpels which dehisce at the apex but remain attached to the axis. DISTRIB. Species about 20; from the Himalaya to China and Japan, North America and the mountains of Central America.

- | | | | |
|---|-----|-----|--------------------------|
| Leaves green beneath; calyx-lobes blunt; petals | | | |
| imbricate | ... | ... | 1. <i>D. corymbosa</i> . |
| Leaves grey beneath; calyx-lobes acute; petals | | | |
| induplicate-valvate | ... | ... | 2. <i>D. staminea</i> . |

1. *DEUTZIA CORYMBOSA*, *R. Br. in Royle, Illustr. Bot. Himal.* (1839) t. 46.—A shrub 4-8 feet high, bark peeling off in thin papery rolls. Leaves 1·5-3·5 by ·7-1·5 inches, ovate-lanceolate, long-acuminate, closely serrate, sparsely hairy on both sides or glabrous beneath, lower surface green; petiole ·1-·4 inch long. Flowers ·5-·7 inch diameter, white, fragrant, in terminal trichotomous corymbose panicles; pedicels slender, ·2-·4 inch long. Calyx dotted with stellate hairs, tube ·1 inch long, teeth ovate, shorter than the tube. Petals ·25-·3 inch long, obovate, imbricate. Stamens 10, those of the inner series (opposite the sepals) longer; filaments broadly winged, the wings ending in a tooth on either side below the anther. Styles usually 3. Capsule ·2 inch diameter.

Himalaya 6-10,000 feet. From Chamba (and Kashmir) eastwards, in moist shady places. Fairly common in Kunawar, elsewhere less common than the following. Flowers: May-June.

2. *DEUTZIA STAMINEA*, *R. Br. in Wall. Pl. As. Rar.* II (1831) p. 82, t. 191.—A shrub 3-4 feet high, bark peeling off in thin longitudinal strips. Leaves 1-3 by ·4-1·5 inches, lanceolate or ovate-lanceolate, acuminate, minutely serrate, scabrid above, grey-tomentose beneath; petiole ·1-·3 inch long. Flowers ·3-·4 inch diameter, in short trichotomous terminal panicles; pedicels ·1-·2 inch long. Calyx matted with stellate hairs, tube nearly ·1 inch long, teeth triangular or linear-oblong, nearly as long as the tube. Petals ·3-·4 inch long, oblong, stellately pubescent, induplicate-valvate. Stamens 10, those of the inner series (opposite the sepals) longer, filaments broadly winged, the wings ending in a tooth on either side below the anther. Styles usually 4. Capsule ·15 inch diameter.

Himalaya 3-9,000 feet. From the Indus (also Trans-Indus) eastwards, common. Usually in open grassy places, on banks, etc. Flowers: April-May.

DEUTZIA SCABRA, *Thunb.*—Is very apt to be mistaken for *D. staminea*. Leaves ovate or ovate-lanceolate, acute, not acuminate. Flowers in racemose panicles. Calyx-lobes ovate.

A native of Japan, sometimes grown in gardens in the plains. Flowers: April.

3. *PHILADELPHUS*, Linn.

(The name of a plant mentioned by Aristotle, which has not been identified by modern botanists. *DISTRIB.* Over 30 species have been described but they are probably capable of considerable reduction; temperate and mountainous Asia and North America.)

PHILADELPHUS TOMENTOSUS, *Wall. Cat.* (1828) No. 3563.—A deciduous shrub about 8 feet high. Leaves opposite, 2-4 by ·8-2 inches, ovate-lanceolate, long-acuminate, irregularly and rather distantly serrate, thin, membranous, glabrous above when mature, glabrous or tomentose and paler beneath,

lateral nerves 2 pairs, sub-basal, arcuate; petiole $\cdot 3\text{--}\cdot 5$ inch long; stipules 0. Flowers $\cdot 8\text{--}1$ inch across, white, very fragrant, 3-7 at the ends of the branches, 3 terminal with or without 1-2 pairs in the axils of the upper leaves; pedicels $\cdot 3\text{--}\cdot 5$ inch long. Calyx-tube $\cdot 2$ inch long, turbinate, glabrous, lobes usually 4, ovate, cuspidate, as long as the tube, usually glabrous without, tomentose at the tips within. Petals usually 4, $\cdot 4\text{--}\cdot 5$ inch long, obovate, contorted. Stamens 20-40, filaments subulate. Ovary inferior, 3-4(-5) celled; styles 3-4 (-5) united for more than half their length; stigmas oblong. Capsule $\cdot 5$ by $\cdot 3$ inch, turbinate, the base slender funnel-shaped, apex shortly conical, calyx-lobes persistent, dehiscing loculicidally. Seeds minute, numerous in each cell. *P. coronarius*, Linn. var. *tomentosus*, C. B. Clarke, in Fl. Brit. Ind., II, p. 407.

Himalaya 7-10,000 feet from Chamba (and Kashmir) eastwards, locally common in forest undergrowth. This plant is apt to be mistaken for *Deutzia corymbosa*, but it is readily distinguished by its simple hairs, those of *Deutzia* being stellate. Differs from *Philadelphus coronarius*, Linn. of Europe in having a loculicidal (not septicidal) capsule. Flowers: May-July.

4. ITEA, Linn.

(The Greek name of the willow; most of the species are of rapid growth and frequently found on banks of streams. DISTRIB. Species 7; Himalaya, Japan and South-East United States.)

ITEA NUTANS, Royle, *Illustr. Bot. Himal.* (1839) p. 226.—A small tree with dark-grey bark. Leaves alternate, 4-6 by 1.5-2.5 inches, elliptic-oblong or elliptic, acuminate, serrate, glabrous, paler beneath, lateral nerves arcuate; petiole $\cdot 5\text{--}8$ inch long; stipules 0. Flowers $\cdot 15$ inch long, white, in fascicles of 2-5, in long slender spike-like racemes longer than the leaves; pedicels $\cdot 05$ inch long, slender, pubescent. Calyx adnate to the base of the ovary, $\cdot 1$ inch long; tube obconic, pubescent; lobes 5, linear, acute, equalling the tube, persistent. Petals 5, linear, erect with incurved tips, valvate, persistent. Stamens 5, filaments subulate. Ovary 2-celled, half-superior; style short, simple, 2-furrowed, persistent, ultimately splitting up to the 2-lobed capitate stigma; ovules many, axile. Capsule $\cdot 2$ inch long including the style, splitting septicidally into two valves which adhere by the bases and stigma.

Sub-Himalayan tract and outer Himalaya ascending to 6,000 ft. from the Indus eastwards. Not common but has been collected in Hazara, Rawalpindi, and in the Sulej Valley. Flowers: April-July. The foliage is much like that of *Ehretia acuminata*.

5. RIBES, Linn.

(From the Arabic name of a plant which has since been ascertained to be *Rheum Ribes*, Linn.)

Shrubs mostly deciduous, sometimes prickly. Leaves simple, usually lobed, stipules 0. Flowers usually small, 1-2-sexual,

in racemes, rarely solitary or clustered. Calyx 4-5-merous, the tube adnate to or produced above the ovary, lobes more or less petaloid. Petals 4-5, usually smaller than the calyx-lobes, inserted at the mouth of the calyx-tube. Stamens 4-5, filaments usually short. Ovary inferior, 1-celled; styles 2, more or less united; ovules numerous on two parietal placentas. Fruit a globose or ovoid berry tipped with the marcescent calyx. **DISTRIB.** Recently monographed by E. de Janczewski who gives the species as about 130; temperate regions of the Northern Hemisphere and the Andes.

Prickly, flowers solitary or clustered ... 1. *R. Grossularia*.

Unarmed, flowers racemose.

Calyx-limb short, spreading.

Sticky-glandular, lobes of the leaves
obtuse ... 2. *R. orientale*.

Nearly glabrous, lobes of the leaves acute 3. *R. glaciale*.

Calyx-limb campanulate or tubular.

Leaves with yellow glands beneath ... 4. *R. nigrum*.

Leaves without yellow glands ... 5. *R. rubrum*.

1. *RIBES GROSSULARIA*, *Linn. Sp. Pl.* (1753) p. 201.—

A small erect stiff shrub armed beneath the buds with 1-3, usually 3, straight strong prickles up to .7 inch long, twigs furrowed pubescent or tomentose when young, bearing inconspicuous gland-tipped hairs or prickly bristles. Leaves crowded on dwarf shoots, .5-1.5 inches broad, orbicular, obtusely 3-5-lobed, lobes inciso-crenate, slightly hairy on both sides, basal nerves 3-7; petiole .5-1 inch long, pubescent, sometimes glandular, stipules 0. Flowers .2-.3 inch across, greenish, bisexual, usually solitary, on short pubescent bracteate peduncles. Calyx adnate to the ovary, bristly-glandular; limb .2 inch long, tubular in the lower half, glabrous within; lobes 5 ovate, spreading in flower. Petals inserted at the mouth of the calyx-tube, shorter than the segments of the calyx, erect in flower, marcescent. Stamens exceeding the petals, filaments broad flattened below narrowed upwards. Style exceeding the stamens, glabrous. Fruit a berry .5 inch long, ovoid, black, tipped with the withered calyx and corolla, glandular-hairy. *The Gooseberry*.

Himalaya in the inner arid region, Kagan, Pangi, Lahaul, Kunawar, 8-12,500 feet. Flowers: May; fruit sour, inedible. The plant above described is *R. alpestre*, Dcne., considered by some botanists a different species from the *Gooseberry* of Europe which has the style and inner portion of the calyx-tube hairy. The prickles unlike the spines of *Berberis* are not modified leaves but excrescences from the stem.

2. *RIBES ORIENTALE*, *Desf. Hist. Arb.* II (1809) p. 88.—

A shrub 6 feet high, twigs pubescent, glandular, sticky. Leaves

·5-1·5 inches broad, orbicular or reniform, obscurely 3-(5-) lobed, lobes inciso-crenate, clothed on both sides with minute pubescence mixed with scattered coarse sticky-glandular hairs, basal nerves 3-5; petiole ·2-1 inch long, stout, pubescent and glandular. Flowers ·15 inch long, purple, polygamo-dicæcious, in erect racemes, 1·5 inches long; bracts linear-lanceolate, ·1-·2 inch long, about as long as or longer than the pedicels. Calyx-tube glandular, scarcely produced above the ovary, lobes ovate. Petals minute, obovate, clawed. Stamens as long as the petals. Style 2-3-fid. Berries ·3 inch diameter, globose, red, sparsely hairy and glandular.

Himalaya in the inner arid region, 7-11,000 feet; Kagan, Pangi, Kunawar. Flowers: April-June. Fairly common in Kagan in the upper portion of the valley.

3. *RIBES GLACIALE*, Wall. in Rowb. Fl. Ind. ed. Carey II (1824) p. 513.—An erect shrub, twigs glabrous. Leaves 1-2 inches long, cordate, 3-5-lobed, lobes acute or acuminate, sharply inciso-serrate, thin, membranous, paler beneath, glabrous or with a few scattered stout hairs above, very minutely pubescent on the nerves beneath; petiole slender, ·5-2 inches long with scattered gland-tipped hairs. Racemes 1·5-2 inches long, pubescent, erect and glandular; flowers polygamo-dicæcious, ·15 inch long, reddish-brown or blackish-purple; bracts ·2-·25 inch long, linear-oblong, usually much exceeding the pedicels, glandular-ciliate. Calyx minutely pubescent, tube scarcely produced above the ovary, lobes oblong, blunt. Petals minute, clawed, limb broader than long, very obtuse. Stamens scarcely exceeding the petals. Style bifid. Berries globose, ·2 inch diameter, red, glabrous.

Himalaya 9-12,000 feet in fairly moist places, from the Indus eastwards. In some specimens from the highest elevations the plant including the leaves and racemes is much reduced in size. Flowers: May-June.

4. *RIBES NIGRUM*, Linn. Sp. Pl. (1753) p. 201.—An erect aromatic shrub 6 feet high, twigs pubescent when young and clothed with sessile yellow resinous glands which are found also on the petioles, lower surface of the leaves, inflorescence and calyx. Leaves 1·5-3 inches long, with a deeply cordate base, 3-5-lobed, coarsely inciso-crenate, 3-5-nerved at the base, nearly glabrous on both sides; petiole 1-2 inches long, broadened and often fimbriate at the base. Racemes 2-3 inches long, few-flowered, pubescent, arising from leaf-producing buds; bracts (according to Hooker & Brandis minute) longer than the pedicels, the lower with dilated tips; flowers bisexual, greenish-yellow, rather large, ·3-·4 inch long, ·2 inch across the calyx-tube, lower pedicels longer than the upper. Calyx campanulate, pubescent within and without, tube produced

above the ovary; lobes oblong, rounded. Petals orbicular, half as long as the calyx-lobes. Stamens nearly as long as the petals; anthers nearly as long as the filament, attached above the base. Style divided nearly to the middle. Berries globose, .3 inch diameter, black, with a strong aromatic smell and taste. *Black Currant.*

Himalaya 7-12,000 feet, Kunawar, rare. There are no specimens in Herb. Dehra from the Punjab and the description is taken from Baltistan specimens.

5. *RIBES RUBRUM*, Linn. *Sp. Pl.* (1753) p. 200.—An erect shrub 10 feet high, twigs glabrous or nearly so. Leaves 1.5-3 inches long, cordate, 3-5-lobed, lobes usually acute or acuminate, inciso-serrate, 3-5-nerved at the base, clothed above with scattered stout pale hairs or nearly glabrous, hairy in the axils of the nerves beneath; petiole slender, 1.5-3 inches long, broadened and often fimbriate at the base. Racemes 2-6 inches long, many-flowered, pubescent, not glandular, usually naked below, sometimes with one small leaf from the same bud; bracts minute, ovate, shorter than the pedicels; flowers bisexual, greenish-yellow, .3 inch long, .1 inch across the calyx-tube. Calyx tubular, glabrous, tube produced above the ovary; lobes obovate-oblong, tips rounded. Petals spathulate, half as long as the calyx-lobes. Stamens as long as the petals, anthers small, much shorter than the filament, attached near the base. Style undivided. Berries .25 inch across, red or black. *Red Currant.*

Himalaya 8-12,000 feet, common, both on the outer and inner ranges, usually in moist forest undergrowth. Flowers: April—May. The black-fruited form is readily distinguished from *R. nigrum*, by the latter having yellow glands on the leaves, &c., and being highly aromatic.

XXXIX. HAMAMELIDACEÆ.

Trees or shrubs. Leaves usually alternate, simple or palmately lobed; stipules rarely wanting. Flowers 1-2-sexual, usually inconspicuous, in heads, spikes or close racemes, heads sometimes surrounded by colored bracts. Calyx usually 4-5-lobed, sometimes wanting. Petals 4-5, perigynous or nearly epigynous or wanting. Stamens 4 to many, free, perigynous or hypogynous; anthers dehiscent by longitudinal slits or by valves. Ovary 2-celled; ovules 1 to many in each cell, axile, pendulous; styles 2, usually persistent, separating and ultimately divaricate. Fruit a 2-valved woody capsule dehiscent at the apex across the dissepiment so as to split each style in two, sometimes afterwards again splitting imperfectly through the dissepiment, endocarp often horny, separating from the exocarp. *DISTRIB.* A small family in Asia, North America, and South Africa.

PARROTIA, C. A. Mey.

(In honor of F. Parrot, a German traveller and naturalist. **DISTRIB.** Species 2; one Persian and the following.)

PARROTIA JACQUEMONTIANA, *Dene. in Jacq. Voy. Bot.* (1844) t. 82.—A large deciduous gregarious shrub 6-12-20 feet high, stellate hairs on the twigs, petioles, stipules, calyx and leaves beneath. Leaves alternate, 1-3 inches long, orbicular or broadly obovate, crenate, membranous, glabrous above, slightly hairy on the nerves and bearded in the axils of the nerves beneath, lowest pair of secondary nerves basal running along the margin for a short distance before entering the blade; petioles .15-.4 inch long; stipules deciduous, oblong, about as long as the petioles. Flowers minute, bisexual, greenish-yellow, about 20 together in an ovoid head, .5 inch across. Heads terminating short lateral shoots, solitary, surrounded by 4 white obovate bracts about 1 inch long. Calyx campanulate, adhering to the base of the ovary, limb thick, woolly, truncate or with a few linear lobes. Petals 0. Stamens usually 15; anthers dehiscent by slits. Ovary semi-inferior. Capsule .4 inch long, ovoid, grey-stellately tomentose, tightly girt in the lower half by the calyx-tube, 2-celled, cells 1-seeded, endocarp horny, separating from the exocarp. Seeds .25 inch long, ellipsoid, brown, polished. Vern. *Pasér* (Rp.), *Killar* (Chamba). *Shá* (Kun.)

Himalaya 3,800-8,500 feet, local. Abundant in the Kagan Valley, Chamba and the Baspa Valley. Also near Murree and Patriata. The plant is markedly gregarious, the growth bearing a striking resemblance to an European hazel coppice wood. It is usually found in deodar forests and is of importance owing to its influence on the reproduction of that species. On the whole its influence on deodar reproduction is not favorable, deodar seedlings come up sparingly under its shade but have much difficulty in piercing the cover, so that deodar reproduction is usually deficient in forests in which *Parrotia* is common. At the same time as these forests are usually rather hot and dry it is by no means certain that the deodar reproduction would be improved if the *Parrotia* were cut and removed. The wood is hard and heavy. It is useful for tent pegs, axe handles, &c. Bark thin, silvery-grey. The twigs are used for making rope-bridges and for wickerwork. The leaves turn yellow in autumn. Flowers soon after the young foliage in March—May.

XL. COMBRETACEÆ.

Trees, shrubs or undershrubs, often climbing. Leaves alternate, subopposite or opposite, simple, entire, exstipulate. Flowers usually bisexual, regular or nearly so, 5-, rarely 4-merous. Calyx often bracteolate at the base; tube adnate to the ovary and prolonged above it; lobes valvate, rarely imbricate, persistent or deciduous. Petals small, valvate, inserted on the calyx or wanting. Stamens incurved in bud, inserted on the calyx, usually twice as many as calyx-lobes, in two series, the lower opposite the calyx-lobes, the upper opposite the petals, filaments free, connective often apiculate. Ovary inferior;

1-celled, usually crowned with a disk; ovules usually 2-5, pendulous from the apex of the cell; style filiform; stigma usually small. Fruit usually dry, indehiscent and 2-5-angled or -winged. Seed 1. DISTRIB. A family found throughout the tropics and in South Africa.

Trees.

- | | | | |
|---------------------------------------|-----|----|---------------------|
| Flowers in spikes; fruit large | ... | 1. | <i>Terminalia</i> . |
| Flowers in globose heads, fruit small | ... | 2. | <i>Anogeissus</i> . |
| Undershrubs or climbers | ... | 3. | <i>Combretum</i> . |

1. **TERMINALIA**, Linn.

(From the Latin *terminus*, end; referring to the disposition of the leaves in some species.)

Large trees. Leaves alternate or subopposite, often crowded at the ends of the branches and usually with glands on the midrib or petiole. Flowers small, greenish or white, spicate, the spikes sometimes paniced, the upper flowers often male. Calyx-tube ovoid or cylindric, constricted above the ovary; lobes 5, short, triangular, valvate, deciduous. Petals 0. Stamens 10, inserted in two series on the calyx, the upper longer alternating with the calyx-lobes, the lower opposite the calyx-lobes. Disk epigynous, within the stamens, densely hairy. Ovules 2-8. Fruit ovoid, indehiscent, smooth or angular or winged. DISTRIB. Species 135; throughout the tropics.

Leaves alternate, crowded towards the ends of the branches ... 1. *T. belerica*.

Leaves mostly sub-opposite, scattered along the branches.

Leaves not more than twice as long as broad; fruit not winged ... 2. *T. chebula*.

Leaves usually more than twice as long as broad, fruit 5-winged.

Bark smooth, pale greenish-grey ... 3. *T. Arjuna*.

Bark rough, dark-grey or black ... 4. *T. tomentosa*.

1. **TERMINALIA BELERICA**, *Roxb. Cor. Pl. II* (1798) p. 54, t. 198.—A large deciduous tree, bark roughish, ashy-grey, often with patches of a bluish color. Leaves 3-8 by 2-6 inches, alternate, crowded towards the ends of the branches, broadly elliptic or elliptic-obovate, puberulous when young, glabrous when mature, coriaceous, pale beneath, margins entire pellucid, subacute or acuminate, base narrowed often unequal; petioles 1-4 inches long, very rarely glandular. Flowers .5 inch across the stamens, pale greenish-yellow, with an offensive odor, in axillary slender interrupted spikes 3-6 inches long. Calyx-tube .2-.25 inch across, pubescent without tomentose within, lobes triangular. Drupe .1 inch long, obovoid, grey-velvety, stone very thick. Vern. *Bahera*.

Sub-Himalayan tract from the Rawalpindi District eastwards. Fairly common, but scattered. Timber yellowish-grey, hard but not durable. It is useful for rough planking, packing cases, &c. The fruit is the *Beleric myrabolam* of commerce but it is not collected in the Punjab. Two varieties differing in habit are found but they are not always well marked. One has a straight erect trunk with rather small branches more or less in whorls, the other has a short trunk with massive irregularly arranged branches. A handsome tree excellent for roadsides except when in flower. Brandis suggests that the glands on the petiole do not exist. They appear to be uncommon. I have often looked for them but only found them once. Flowers: April—June.

2. *TERMINALIA CHEBULA*, Retz, Obs. fasc. 5 (1789)
p. 31.—A medium-sized deciduous tree, bark dark-brown somewhat roughish. Leaves 3-7 by 2-3.5 inches, subopposite or sometimes alternate, broadly elliptic-oblong, glabrous when mature, usually acute, base usually rounded often unequal-sided; petiole .5-1 inch long, often with 2 or more glands on the upper side near the top. Flowers .2 inch across the stamens, pale yellowish-white, all bisexual, in axillary and terminal often paniculate spikes 1.5-4 inches long. Calyx-tube .15 inch across, glabrous without, hairy within; lobes short, sometimes obscure. Drupe 1-1.5 inches long, usually obovoid, yellowish-green, more or less 5-angled when dry, glabrous, stone very thick, obscurely angled. Vern. *Harar*.

Sub-Himalayan tract from the Kangra District eastwards, locally fairly common. Wood very hard, brownish-grey with a greenish or yellowish tinge and a small dark purple heartwood, fairly durable. The fruit is the *Black myrabolam* of commerce and is regularly collected by villagers in the Kangra District, being used for tanning, dyeing, and medicinally. As a wild tree it is usually rather small but when cultivated reaches a large size and has often longer and more pointed leaves. The tree would be worth trying on roadsides where the soil is deep as the fruits are readily saleable. Flowers: April—June.

3. *TERMINALIA ARJUNA*, Wight & Arn. Prodr. (1834)
p. 314, in textu.—A large tree with smooth pale greenish-grey bark, trunk sometimes buttressed. Leaves 4-10 by 1.7-3.5 inches, usually subopposite, oblong, obtuse or subacute, base rounded or cordate, often unequal-sided, glabrous above, more or less pubescent beneath, often crenate-serrate in the upper part or throughout, usually with a pair of glands on the blade beneath close to the top of the petiole; petiole .25 inch long. Flowers pale yellowish-white, in axillary and terminal usually paniculate spikes 2-3 inches long. Calyx-tube broadly campanulate, .1 inch across, glabrous, teeth triangular, .05 inch long. Drupe 1-2 inches long, with 5 hard projecting wings, wings less than .5 inch wide, striate with numerous ascending veins. Vern. *Arjan*.

Indigenous to Central India. Cultivated in gardens throughout the Punjab especially in the Kangra District where it is sometimes found growing spontaneously along streams. Often cultivated as a roadside tree in Kangra

and at low elevations in Hazara. Sapwood reddish-white, heartwood brown variegated with darker streaks, very hard. A very handsome tree but requires a deep soil and a fairly plentiful supply of moisture. Flowers: April—May.

4. *TERMINALIA TOMENTOSA*, *Wight & Arn. Prodr.* (1834) p. 314.—A large deciduous tree, bark dark-grey or black, much furrowed longitudinally, young parts with yellowish-brown pubescence. Leaves 5-9 by 2·5-4 inches, subopposite or the upper alternate, oblong, elliptic, ovate- or obovate-oblong, glabrescent above, more or less tomentose beneath, hard, coriaceous, entire or serrulate, obtuse or shortly pointed, base often cordate, midrib beneath often with 1-2 glands which are turbinate and often stipitate; petioles ·3-·4 inch long. Flowers dull-yellow, bisexual, in erect terminal paniculate spikes or the lower branches axillary. Calyx-tube ·1 inch across, cup-shaped, glabrous or hairy, teeth ·05 inch long, triangular. Drupe 1·5-2 inches long, with 5 broad coriaceous wings, wings over ·5 inch wide, striate with numerous horizontal veins. Vern. *Sain, aisan* (Ka.)

Sub-Himalayan tract. Common near the Jumna becoming rarer further west and stopping before the Ravi. Sapwood reddish or yellowish-white, heartwood dark-brown with darker streaks. The wood is very hard and heavy but not very durable. It is used for building and many other purposes. The tree is of little importance in the Punjab being common only in the Kalesar Reserve. It would be worth trying in irrigated plantations as it likes a deep soil and seedlings stand considerable shade when young. The growth is fairly fast and the stem usually cylindric and little-branched. It is apparently frost hardy. Flowers: June—August.

2. *ANOGEISSUS*, Wall.

(From the Greek, *ano*, above, and *geisson*, a covering roof.)

Deciduous trees. Leaves alternate or subopposite, without glands. Flowers small, yellow, in dense, globose, axillary, pedunculate heads. Calyx-tube produced above the ovary as a slender persistent beak, expanding into a 5-lobed campanulate deciduous limb. Petals 0. Stamens 10, biseriate. Disk of 5 episepalous hairy processes. Ovules 2. Fruits packed in dense heads, small, compressed, 2-winged, beaked. *DISTRIB.* Species 5; one African, the rest Indian.

Bark whitish-grey; leaves mostly over 2 inches long; peduncles mostly branched ... 1. *A. latifolia*.

Twigs slender pendulous; leaves mostly under 1·5 inches long; peduncles unbranched ... 2. *A. pendula*.

1. *ANOGEISSUS LATIFOLIA*, *Wall. Cat.* (1828) No. 4015.—A tall tree, bark smooth whitish-grey. Leaves 2-4 by 1-2·5 inches, elliptic, acute or obtuse, glabrous or nearly so; petiole ·3-·5 inch long. Flower-heads ·25-·3 inch diameter, on short axillary peduncles 1 or more from the same leaf-axil, often

branched. Calyx-tube .08 inch long, pubescent, the campanulate limb .08 inch across, teeth minute, broad-triangular. Stamens exserted. Fruit about .2 inch long excluding the beak and nearly as much across the wings, yellowish-brown, beak as long as or longer than the nucleus. Vern. *Dhao* (Ka.); *chāl, bākki*

Sub-Himalayan tract and Siwalik Hills from the Ravi eastwards, common and often more or less gregarious. Wood grey, hard, shining, smooth, with a small purplish-brown irregularly shaped heartwood. Tough and elastic but not durable when exposed. Usually of small girth but good height growth with an erect little-branched bole. It is used for agricultural implements, house building, &c. The leaves are used for tanning and the tree gives a gum which is used for calico printing. The foliage turns a copper color in the cold season and is shed in the hot weather. Flowers: May-June.

2. *ANOGEISSUS PENDULA*, *Edgew. in Journ. As. Soc. Beng.* XXI (1853) p. 171.—A small tree, bark smooth grey often silvery, twigs slender pendulous. Leaves .7-1.2 by .4-.6 inch, elliptic or obovate, obtuse or acute, usually mucronate, base narrowed, glabrous or more or less adpressed, silky hairy on both sides; petiole .1 inch long. Flower-heads .2 inch diameter, on slender axillary unbranched peduncles. Fruit about .2 inch long and broad, excluding the beak which is about half as long as the nucleus. Otherwise as for *A. latifolia*.

Hills of the South-East Punjab; Tanki Hill, Gurgaon. Also near Delhi but doubtless planted. The principal tree of Rajputana where it is gregarious and covers the rocky hills often almost to the exclusion of other plants. It would be worth introducing a few plants into the Pabbi Hills in the hope that it may spread naturally. This would probably have to be done by planting as sowings have not been successful when tried in Jaipur State where the tree is abundant. It is occasionally cultivated and is very ornamental when well grown. The foliage in the cold weather turns a dull red-brown color and is shed at the beginning of the hot weather. Wood similar to that of *A. latifolia*. Flowers: August-September.

3. *COMBRETUM*, Linn.

(A name used by Pliny for some climbing plant which has not been identified by modern botanists.)

Trees, shrubs or undershrubs, often climbing. Leaves usually opposite. Flowers bisexual or polygamo-dioecious, in spikes, racemes or panicles, 4-5-merous. Calyx-tube cylindric, 4-5-angled, the angles alternating with the calyx-teeth, sometimes with additional angles which run up into the calyx-teeth, limb campanulate 4-5-fid. Petals 4-5, usually small, rarely wanting. Stamens usually 8 or 10, biseriate. Disk thin, at the base of or lining the calyx-tube, in the latter case ending in a hairy ring. Ovules 2-6. Fruit dry, usually indehiscent, 4-5-angled or -winged. **DISTRIB.** Species about 160; Tropical Asia, America and Africa, also in South Africa.

A climbing shrub. Flowers 5-merous ... 1. *C. decandrum*.
An undershrub. Flowers 4-merous ... 2. *C. nanum*.

1. *COMBRETUM DECANDRUM*, *Roxb. Cor. Pl. I* (1795) p. 43, t. 59.—A large climbing shrub, young parts silky-pubescent. Leaves opposite, 3-5 by 1·5 - 2·5 inches, elliptic-oblong, or elliptic, abruptly acuminate, glabrous when mature, lateral nerves 6-8 pairs, prominent beneath, arcuate; petioles ·2-·4 inch long. Flowers ·2 inch across, greenish-white, in dense villous racemes about 1 inch long, the racemes arranged in large terminal panicles in the axils of leaf-like creamy-white bracts 1-2 inches long; bracteoles ·2 inch long, linear-lanceolate, villous, subpersistent. Calyx-tube nearly ·1 inch long, hairy; limb cup-shaped, as long as the tube, hairy; lobes linear-subulate. Petals 5, small, oblong, glabrous. Stamens 10. Fruit 1 inch long, ·5-·8 inch broad, oblong or elliptic, with 5 papery wings.

Sub-Himalayan tract. I have seen no Punjab specimens but it occurs in the Punjab according to Duthie (*Flora Upper Gang. Pl., I*, p. 338). Kanjilal (*For. Fl.*, ed. 2, page 211) mentions that it is abundant on the east bank of the Jumna and conspicuous in flower owing to the white bracts. Flowers: February—March.

2. *COMBRETUM NANUM*, *Buch.-Ham. in D. Don, Prodr. Fl. Nep.* (1825) p. 219.—An undershrub up to 2 feet high, sending up annual woody shoots from a stout rootstock. Leaves opposite and alternate, 2-4 by 1·2-2·5 inches, broadly elliptic, ovate or obovate, coriaceous, glabrous, very inconspicuously punctulate on both sides, lateral nerves 3-4 pairs, arcuate; petiole ·1-·2 inch long, scurfy. Flowers ·25 inch across, white, in simple or few-branched racemes 1-4 inches long; bracteoles linear-spathulate, caducous. Calyx-tube ·15 inch long, scurfy; limb funnel-shaped, nearly ·1 inch long, very hairy within; lobes triangular-ovate. Petals 4, cuneate-obovate, exceeding the calyx-lobes. Stamens 8, much exserted. Fruit 1·5 inches long by 1 inch broad, elliptic, pink or red, with 4 broad papery wings.

Sub-Himalayan tract from the Indus eastwards. Apparently not common. I have collected it once in the Massar Reserve, Hazara. A shrub of grassy places in Chil forests and on fire-lines. This is one of the plants which Brandis suggests has become dwarfed by annual jungle fires,—*vide* the remarks under *Grewia sapida*. According to Haines the leaves are red when young and turn brilliant red in winter before falling. Flowers: March—April.

COMBRETUM COCCINEUM, *Lamk.*—A climbing shrub. Leaves about 4 by 1·7 inches, oblong, glabrous. Racemes 2-5 inches long, arranged in terminal panicles, the lower axillary. Calyx-tube ·2 inch long; limb ·15 inch long, campanulate, teeth short, triangular, ciliate. Petals 5, elliptic, ·2 inch long, brilliant scarlet. Stamens 10, much exserted.

Native of Madagascar and Mauritius. Occasionally grown in gardens in the plains and very handsome when in flower. Flowers: June—September.

QUISQUALIS INDICA, *Linn.*—A large scandent shrub. Leaves opposite, 2-4 inches long, elliptic, acuminate, rusty-pubescent beneath and on the nerves

above; petioles 2-4 inch long. Flowers 2-5 inches long, 1-5 inches across, at first white, soon turning pink, in axillary and terminal spikes. Calyx-tube very slender, 2-5 inches long, limb 5-toothed. Petals obovate-oblong with broad bases. Stamens 10, 5 shortly exserted opposite the petals, 5 subincluded.

Indigenous to Malaya. Commonly planted in gardens and known as the *Rangoon Creeper*. Rarely if ever fruits in Northern India. Flowers most of the year, white, sweet-scented, appearing at night but turn pink at daybreak.

XLI. MYRTACEÆ.

Trees or shrubs. Leaves usually opposite entire and evergreen, often with an intra-marginal vein and gland-dotted. Flowers almost always bisexual, regular, perigynous or epigynous. Calyx-tube adnate to the ovary and often prolonged above it, limb 4-5-fid or -partite, persistent or deciduous, valvate or imbricate, or forming a deciduous calyptra. Petals 4-5, imbricate, sometimes united into a calyptra, rarely wanting. Disk lining the calyx-tube. Stamens numerous, free or connate or in bundles which are usually opposite the petals; anthers usually dorsifixed and versatile, connective often bearing a gland, cells dehiscing longitudinally or sometimes by pores. Ovary 1-celled with 1-many ovules or more often 2-many-celled with many ovules; style simple; stigma simple. Fruit a berry, drupe, capsule or nut-like. **DISTRIB.** A large family in tropical and sub-tropical regions of both hemispheres.

Leaves opposite, entire, gland-dotted ... 1. *Eugenia*.

Leaves alternate, crenate-serrate, not gland-dotted ... 2. *Careya*.

1. *EUGENIA*, Linn.

(In honor of Prince Eugene of Savoy of the 17th century, a patron of botany. **DISTRIB.** Species about 650; throughout the tropics but mainly in Asia and America.)

EUGENIA JAMBOLANA, Lamk. *Encyc. Méthod.* III (1789) p. 198.—A large evergreen tree, bark light-grey nearly smooth. Leaves opposite, very variable, usually 3-6 by 1-5-2-5 inches, lanceolate, elliptic-oblong or broadly ovate-elliptic, acute, acuminate or subobtuse, coriaceous, smooth and shining above, pellucid-punctate, main lateral nerves very numerous, fine and parallel, uniting into an intramarginal nerve; petioles 3-1 inch long, channelled. Flowers about 3 inch across, dirty-white, fragrant, arranged mostly in threes in trichotomous panicles usually below the leaves. Calyx-tube 2 inch long, turbinate; limb truncate or obscurely 4-lobed. Petals united into a thin, membranous calyptra. Stamens numerous; anthers small, versatile, dehiscing longitudinally. Ovary inferior, 2-celled; ovules many in each cell; style filiform; stigma small. Fruit very variable in size, up to 1 inch long, obovoid-

oblong or sub-globose, crowned with the truncate calyx limb, first pink then black with pink juicy pulp. Seed 1. *The Jaman*. Vern. *Jáman*.

Sub-Himalayan tract from the Rawalpindi District eastwards. Often planted and self-sown. As a wild tree it is found mainly along streams and in very moist places, with less coriaceous and more lanceolate leaves. This form is var. *caryophyllifolia*, it is very common in Kangra. Vern. *katháman*. The *Jáman* is frequently planted for its fruits which are rather astringent. It is also used (var. *caryophyllifolia*) to shelter mango groves in the Amritsar District and elsewhere, being planted close together as a wind-break round the groves. The wood is reddish-brown, tough and hard but not very durable except under water. An excellent shade and avenue tree on moist deep soil. Flowers: March—May.

EUGENIA JAMBOS, Linn.—A small evergreen tree. Leaves opposite, 5-6 by 1-1.5 inches, lanceolate, acuminate; petiole .2 inch long, very stout. Flowers greenish-white, 2-3 inches across, in short terminal corymbs. Berry 1-2 inch diameter, globose or obovoid, yellow or pink, with a rose like aroma when ripe. The *Rose Apple*.

Indigenous to Malaya and Upper Burma. Occasionally grown in gardens in the plains. It does only fairly well in Lahore. Flowers: April—May.

EUGENIA BRACTEATA, Roxb.—An evergreen shrub, young shoots and inflorescence rusty-pubescent. Leaves opposite, 1-3 inches long, elliptic. Flowers .3 inch across, white, on slender axillary 1-flowered peduncles which are usually paired. Calyx-lobes 4, distinct. Petals 4, free. Berry .5 inch diameter, orange or scarlet, globose, 1-2-seeded, tipped by the persistent calyx-lobes.

Indigenous to South India and Assam. Occasionally grown in gardens and not unlike the Myrtle. Flowers: May.

2. CAREYA, Roxb.

(In honor of the Rev. William Carey, of Serampore, a distinguished botanist, who published Roxburgh's manuscript *Flora Indica*. DISTRIB. Species 4; India and North Australia.

CAREYA ARBOREA, Roxb. *Cor. Pl.* III (1819) p. 14, t. 218. —A medium-sized deciduous tree, bark dark-grey exfoliating in thin strips. Leaves alternate, 6-12 by 3-6 inches, broadly obovate or obovate-oblong, rounded or shortly acuminate, crenate-denticular, rather membranous, glabrous, lateral nerves 10-12 pairs; petiole 0-7 inch long, stout, margined. Flowers 2.5-3.5 inches across, white, ill-smelling, sessile, in thick swollen hard terminal spikes each with a central elliptic bract and two linear lateral ones. Calyx about 1 inch long, tube campanulate, not produced above the ovary; lobes 4, rather shorter than the tube, oblong, obtuse, stiff, erect. Petals 4, 1.5-2 inches long, elliptic-oblong, obtuse or subacute. Stamens very numerous, epigynous, in several rows; filaments equalling or slightly exceeding the petals, connate into a tube at the base, the innermost and outermost rows usually without anthers; anthers versatile, dehiscent longitudinally. Disk annular, crowning the top of the ovary. Ovary 4-celled (rarely 5-celled); ovules numerous, biseriate, axile. Fruit 2.5-3 inches diameter, globose, green, glabrous, crowned with the calyx-segments and remains of the style.

Sub-Himalayan tract from the Kangra District eastwards, rather local. Usually a small tree but reaches a fair size on good soil. Heartwood rather scanty, dull-red or reddish-brown, hard, durable, sapwood whitish. An ornamental tree but very rarely cultivated. The leaves turn red in the cold season. Flowers in March and April when the leaves are being renewed.

MYRTUS COMMUNIS, *Linn.*—An evergreen shrub. Leaves opposite, about 1 inch long, ovate-lanceolate, pellucid-punctate. Flowers .5 inch diameter, white, usually solitary on slender axillary peduncles .5-.7 inch long. Calyx-limb 4-5-cleft. Petals 4-5, free. Stamens numerous. Ovary 2-3-celled. Berries black. *The Myrtle.*

Indigenous to South Europe extending to Afghanistan. The genus is only distinguished from *Eugenia* by the embryo. The Myrtle is often cultivated in the Punjab. It is apt to be mistaken for *Eugenia bracteata* but has smaller leaves and rather larger flowers which are almost always solitary.

PSIDIUM GUYAVA, *Linn.*—A large shrub or small tree. Leaves opposite 4-6 inches long, oblong or elliptic-oblong, glabrous above, pubescent beneath, pellucid-punctate, lateral nerves 15-20 pairs, prominent, strongly curved near the edge and joined by intramarginal veins; petioles .1-.3 inch long. Flowers 1 inch across, white; peduncles .5-1.5 inches long, axillary, 1-3-flowered. Calyx-tube adnate to the ovary and produced above it, the upper free portion entire, closed in bud at length bursting irregularly into lobes. Petals 4 or 5, free. Stamens numerous. Ovary 4-5-celled, the parietal placentas almost meeting in the centre; ovules numerous in each cell. Fruit a globose or pyriform berry 2 inches long or more. *Guava.* Vern. *Amrûd.*

Indigenous to Mexico. Frequently cultivated for its fruits. Flowers : May.

BARRINGTONIA ACUTANGULA, *Gartn.*—A medium-sized tree. Leaves alternate, crowded towards the ends of the branches, 2.5-6 by 1.2-3.2 inches, obovate-oblong or oblanceolate, crenate or denticulate, base narrowed, epunctate, petioles .1-.2 inch long. Flowers .3-.5 inch across, deep-scarlet, fragrant, in slender pendulous many-flowered racemes 6-15 inches long. Calyx .2 inch long, the tube not produced beyond the ovary; lobes 4, equalling the tube, oblong, rounded, ciliate. Petals 4, adnate to the staminal-tube. Stamens numerous, filaments .7 inch long, connate into a ring. Ovary 2-celled. Fruit 1 inch long, oblong, bluntly quadrangular, slightly narrowed towards the truncate ends, crowned by the small persistent calyx-lobes. Seed 1.

Indigenous east of the Ganges. Grown in gardens for its flowers and does well. Flowers : June.

CALLISTEMON LANCEOLATUS, *DC.*—A small evergreen tree, young shoots and inflorescence loosely hairy. Leaves alternate, 2.3-5 by 2.3 inch linear-lanceolate, narrowed at both ends, sharply pointed, not rigid, midrib and marginal veins conspicuous, gland-dotted. Flowers crimson, in terminal spikes 3-6 inches long, the branches soon growing through the spikes. Calyx-tube .15 inch long, campanulate; lobes 5, obtuse. Petals 5, about .2 inch long, sub-orbicular. Stamens very numerous, 1 inch long, crimson, anthers dark. Ovary 3-4-celled; ovules numerous. Fruit a woody cupshaped capsule .2 inch long and nearly as much across the truncate apex. *The Bottle Brush Tree.*

Indigenous to Queensland and New South Wales. Often cultivated in gardens in the plains and in Abbottabad. Other species of the genus have been introduced but they are rarely seen. Flowers : March—August.

MELALEUCA LEUCADENDRON, *Linn.*—An erect evergreen tree with soft spongy white bark which peels off in thin layers. Leaves alternate, 2-4 by 4-7 inch, elliptic-oblong, thick, longitudinally 3-7-nerved, gland-dotted;

petiole very short. Flowers creamy-white, in dense terminal spikes about 2 inches long, the branches soon growing through the spikes. Calyx-tube .12 inch long, ovoid, lobes 5, short, orbicular. Petals about .1 inch long, suborbicular. Stamens less than .5 inch long, filaments connate into bundles of 5-8, opposite the petals. Ovary 3-celled; ovules numerous. Fruit a woody capsule about .2 inch across, globular or hemispheric.

Indigenous to Australia and Malaya. Cultivated in the Punjab. The tree varies considerably, the form usually seen in the Punjab has small leaves as above described but a form with leaves 6-8 inches long has also been introduced. This form has much the appearance of an Eucalyptus, it flowers in March and has drooping leaves, twigs and inflorescence. The small-leaved form flowers in October.

MELALEUCA GENISTIFOLIA, *Smith*.—A small elegant tree. Leaves alternate, up to 7 by .1 inch, linear-lanceolate, acute, spikes about 1 inch long, at first terminal. Calyx-lobes triangular. Stamens .2 inch long, yellow.

Indigenous to Australia. Has long been grown in Saharanpur and recently in Lahore. Flowers: April.

EUCALYPTUS, *L'Héritier*.—Evergreen trees or shrubs, usually glabrous, often reaching a gigantic size, usually secreting aromatic resinous gum. Leaves usually alternate, mostly vertical, more or less falcate, gland-dotted, generally thick, penniveined, always with an intramarginal vein. In seedlings the leaves are usually opposite and generally differently shaped from those of mature plants. Flowers ebracteate, usually white, in simple or paniculate umbels, bisexual. Calyx-tube adnate to the ovary and often produced beyond it. Orifice of the calyx-tube closed in bud by a cap (*operculum*, variously interpreted as representing the petals or calyx-limb or both) which falls off when the stamens expand. Stamens numerous, in many rows, mostly free, usually inflexed in bud. Ovary inferior, 3-6-celled; ovules numerous, axile; style undivided. Fruit a capsule opening at the top by 3-6 valves, usually hard and woody. Seeds numerous, minute or rather small, comparatively few fertile, these being somewhat larger than the abortive ones. *DISTRIB.* Species about 150; almost confined to Australia, a few in the neighboring islands.

Very many species have been introduced into India and some are commonly planted in all large stations in the plains. Their cultivation has been taken up from time to time by the Forest Department, of recent years particularly in the Simla Hills so that a few notes on their cultivation and the description of the species most often seen have been given.

CULTIVATION.—Eucalypts may be sown direct in seed beds and under favorable conditions for the species selected require no further attention beyond weeding and thinning out the plants when too crowded. Some species which damp off readily when grown in pots do not suffer nearly so much in seed beds provided the drainage is good. This method of growing eucalypts is only available in favorable localities and in the plains the seed is usually sown in pots. Light soil must be used and the seed should be sown fairly thickly and lightly covered. The young plants need slight protection from the sun in the middle of the day and are particularly sensitive to excessive moisture. As soon as the seedlings are large enough to handle they should be put into separate pots to be planted out in their permanent situations when 1-2 feet high. The most critical period for young plants is the first monsoon and many species which stand the rains well when 3-4 feet high, may die off in large numbers if the monsoon starts when they are only 3-4 inches high. If the seed is sown early in March most species will be large enough to plant out as soon as the rains begin but for some species and in places where the winter is not too damp and cold sowing in October gives better results.

Eucalypts form a deep tap root and consequently do not transplant well except when they are quite small. As far as is known all species are highly light demanding and coppice well. The rate of growth in many species is fast but it is not so in all, though some make phenomenally rapid growth. The timber is usually very hard and heavy but warps and splits badly especially when sawn from young trees and if the centre of the tree has not been avoided when sawing. Young plants are subject to attack by white ants and when these are very numerous it is difficult to grow eucalypts.

The species are difficult to discriminate and are variable under cultivation, no one character can be relied upon to distinguish them. Some species show a great variation from the types met with in Australia and if this variation continues at the same rate they will in a few generations become quite unrecognisable. As however seed is constantly being imported from Australia I have based the descriptions on the types met with in that country. The following key does not take into account abnormal forms which can only be identified from the sum of their characters.

I. Bark on the stem and branches rough, hard and deeply fissured. (*Ironbarks*).

Leaves alternate.

Capsules large, .25 inch diameter or more, valves enclosed, capsule with a "rim" more or less contracting the mouth ...

1. *E. sideroxylon*.

Capsules smaller without a "rim."

Operculum long, conical, exceeding the calyx-tube ...

2. *E. siderophloia*.

Operculum short, not exceeding the calyx-tube.

Anthers opening by ample lateral pores ...

3. *E. crebra*.

Anthers truncate, opening by small terminal pores ...

4. *E. paniculata*.

Leaves opposite ...

5. *E. melanophloia*.

II. Bark of a fibrous or flaky character, rough but not hard or deeply fissured.

Valves enclosed, leaves paler beneath ...

6. *E. robusta*.

Valves exserted; fruits not longer than broad.

Border of the capsule more or less depressed ...

7. *E. Kirtoniana*.

Border of the capsule very convex ...

8. *E. rudis*.

III. Bark on stem and branches smooth, sometimes rough near the base of the stem. (*Gums*).

Valves enclosed, leaves lemon-scented ...

9. *E. citriodora*.

Valves exserted.

Capsules large .7-1 inch diameter ...

10. *E. globulus*.

Capsules small.

Top of the calyx-tube concave leaving a space between the edge of the calyx-tube and the slightly exserted valves ...

11. *E. saligna*.

Top of the calyx-tube convex, valves completely exserted.

Operculum long, conical ...

12. *E. tereticornis*.

Operculum short, abruptly pointed ...

13. *E. rostrata*.

1. *EUCALYPTUS SIDEROXYLON*, *A. Cunn. in Mitch. Journ. Trop. Austral.* (1848) p. 339.—A large tree, bark very hard and rough. Leaves usually 4-5 inches long, only slightly falcate, often glaucous, those of seedlings narrow-linear. Flowers rather large, in axillary usually 3-flowered umbels, often pink or crimson. Operculum conico-hemispheric, pointed, slightly shorter than the calyx-tube. Anthers small, truncate, opening by small terminal pores. Fruits about 4 inch long by 3 inch diameter, slightly contracted at the mouth which is furnished with a thin fairly broad deciduous rim, valves completely enclosed. *E. leucowylon*, *Brandis, Ind. Trees*, p. 327, *ex parte*. *Red Iron Bark*.

Indigenous to East Australia from Queensland to Victoria. Cultivated in Abbottabad and Changa Manga. The stem is usually crooked and gives off large branches. It does badly in Changa Manga and the heartwood of stumps and standing trees is eaten by white ants. It cannot therefore be recommended for the plains but a red flowered form with glaucous bluish foliage is very handsome and grows well in Abbottabad. Flowers: September.

2. *EUCALYPTUS SIDEROPHLOIA*, *Benth. Fl. Austral.* III (1866) p. 220.—A large tree, with straight stem, bark not so hard or deeply fissured as in *E. sideroxylon*. Leaves 3-6 inches long, usually falcate, rather thick, those of seedlings broadly ovate, coarse. Flowers in axillary or terminal paniculate umbels. Operculum conical, usually exceeding the calyx-tube. Anthers small, globose, opening by oblong slits. Fruits about 25 inch across, not contracted at the mouth, valves usually much exserted. *Broad-leaved Ironbark*.

Indigenous to Queensland and New South Wales. Planted in Changa Manga. This tree grows well in the plains and in Australia yields a valuable timber. It is easily recognized from other Ironbarks by its coarse foliage combined with the long operculum and exserted valves to the fruit. Flowers: April.

3. *EUCALYPTUS CREBRA*, *F. v. M. in Journ. Linn. Soc.* III (1859) p. 87.—A large tree, stem sometimes forked, often with numerous switchy branches, bark very hard and rough. Leaves 3-6 inches long, usually falcate, narrow, those of seedlings narrow-linear. Flowers normally very small, umbels axillary or paniculate. Operculum hemispheric or low-conical, not exceeding the calyx-tube. Anthers opening by ample lateral pores. Fruit very variable, normally 1-2 inch diameter more or less contracted at the mouth with enclosed valves but a common form in India has the fruits fully 2 inch diameter with the valves more or less completely exserted. *Narrow-leaved Ironbark*.

Indigenous to Queensland and New South Wales. Cultivated in Lahore; Amritsar; Narpur, Kangra, &c. The normal small fruited form is not easily mistaken but the large fruited forms are exceedingly like *E. paniculata*, differing however in the anthers. The forms with prominently exserted valves to the fruit are apt to be mistaken for *E. siderophloia* from which they can be distinguished by the shorter operculum and much less coarse foliage especially of seedlings and sucker-shoots. The timber is one of the best of the genus, imported sleepers of *E. crebra* having given excellent results on the O. & R. Railway. The growth is slow for Eucalyptus but I have seen a tree in Amritsar fully 100 feet high and 7 feet in girth which cannot be more than about 50 years old and may be considerably less. Flowers December—January. Closely allied to this species is *E. Staigeriana*, *F. v. M.*, it is grown in Saharanpur and possibly will be found in the Punjab. It is easily recognized by its lemon-scented foliage combined with the rough bark.

4. *EUCALYPTUS PANICULATA*, *Sm. in Trans. Linn. Soc.* III (1797) p. 287.—A large tree, bark not so rough as in *E. crebra*. Leaves 4-5 by 1 inch, usually not falcate, those of seedlings not very different to the mature

foliage. Umbels in terminal panicles. Operculum low-conical, as long as or shorter than the calyx-tube. Anthers truncate, opening by minute terminal pores. Fruits usually about .25 inch diameter, .3 inch long, valves usually enclosed. *White or Grey Ironbark.*

Indigenous to New South Wales extending into the neighboring states. This tree has been grown and distributed from the Botanic Gardens, Saharanpur, for many years. The timber is valued in Australia for its strength and durability but it is not proof against white ants. The tree is apt to be mistaken for *E. crebra*, see the remarks under that species. There are a few specimens in Changa Manga. Flowers: September—October.

5. *EUCALYPTUS MELANOPHLOIA*, *F. v. M. in Journ. Linn. Soc. III* (1859) p. 93.—A fairly large tree, stem usually straight, little-branched, bark very dark colored, rough. Leaves opposite (in the form grown in India), 1.5-3 by 1-2 inches, not falcate, glaucous especially on young plants. Umbels in panicles. Operculum hemispheric, pointed or very low-conical. Anthers opening by ample lateral pores. Fruits .2 inch diameter, goblet-shaped, often contracted at the mouth, valves enclosed. *Silver-leaved Ironbark.*

Indigenous to the drier parts of Queensland and New South Wales. Cultivated in Lahore and Changa Manga. The growth in height is fast but young plants are apt to be spindly. The tree stands drought well. The leaves turn a peculiar slaty color when dry. Flowers: May—June.

6. *EUCALYPTUS ROBUSTA*, *Sm. in Bot. N. Holl.* (1793) p. 39.—A medium sized tree, bark rough but not hard, flaky. Leaves 4-6 inches long, ovate-lanceolate, placed horizontally, dark-green above, paler beneath, acuminate, those of seedlings similar to the mature leaves. Flowers in axillary umbels, 3-10-flowered, peduncle flattened. Operculum conical, about equalling the calyx-tube. Anthers opening by slits. Fruits about .5 inch long, .3 inch across, ovate-truncate, valves coherent, enclosed. *Swamp Mahogany.*

Indigenous to New South Wales and Queensland. Grown in Lahore, Kapurthala, also in Saharanpur. As its English name indicates the tree requires plenty of water and it does not do well without it. Young plants are vigorous and ornamental but except in wet places they reach a height of only 20-30 feet, are branchy and have much dead wood in the crowns. It can only be recommended for really wet or swampy places.

7. *EUCALYPTUS KERTONIANA*, *F. v. M. in Eucalyptographia, Dec. VII* (1880) *sub E. robusta*.—A large tree, bark rough but not hard or deeply fissured, rather fibrous. Leaves variable, mostly vertical on young trees, mostly horizontal on older trees, 5-8 inches long, rather thick, equally colored on the two sides, the juvenile leaves much like those of *E. robusta*, usually with a reddish tinge. Flowers rather large, in axillary umbels, peduncles more or less flattened. Operculum broadly conical, about equalling the calyx-tube. Anthers opening by slits. Fruits .4 inch diameter, valves completely exerted.

Indigenous to New South Wales. Cultivated in Lahore, also in Saharanpur. It does well in the plains but requires a good deal of moisture. According to Maiden (Forest Flora of N. S. W. I, 66) this is a variety of *E. resinifera*, *Sm.*, which however although it has been repeatedly tried, cannot be grown in the plains. It was formerly grown in the Carob Plantation at Lahore now the grounds of the Punjab Club where a good many specimens are left. Flowers: October—November.

8. *EUCALYPTUS RUDIS*, *Endl. in Enum. Pl. Hueg.* (1837) p. 49.—A large or fairly large tree, bark grey rough persistent but not deeply furrowed. Leaves 4-7 inches long, more or less curved or often especially on young trees ovate, juvenile foliage broadly ovate often with a red or bronze hæc. Flowers

in 3-8-flowered solitary axillary umbels, peduncle and pedicels rather slender. Operculum broadly conical, slightly exceeding the calyx-tube. Anthers opening by slits. Fruits 3 inch diameter, valves completely exserted.

Indigenous to West Australia. Recently introduced into the Punjab and has been making remarkable growth in Lahore, plants 3 years old having reached 30 feet in height and 1 foot 8 inches in girth. Appears to require a dry climate. In young trees the bark is nearly smooth and consequently *E. rudis* is apt to be confused with *E. tereticornis*. In *E. tereticornis* the fruits are rather smaller and the operculum usually distinctly longer than in *E. rudis*. In *E. rudis* the crown is composed of rather large ascending branches which are not found in *E. tereticornis*. Flowers: October—February.

9. *EUCALYPTUS CITRIODORA*, Hook. in Mitch. Journ. Trop. Austral. (1848) p. 235.—A tall tree with slender erect stem and smooth bark. Leaves 6-8 inches long, lanceolate, usually falcate, bright green, when crushed with an exquisite lemon scent, those of seedlings hairy, attached petiolately to the petiole, lanceolate, horizontal. Flowers in usually 3-flowered umbels arranged in panicles on short leafless branches. Operculum hemispheric, abruptly shortly pointed. Stamens opening by slits. Fruits rather large, 5 inch long by 4 inch diameter, ovoid-urceolate, valves deeply enclosed. *Lemon-scented Gum*.

Indigenous to Queensland, cultivated everywhere in gardens in the plains, also in Abbottabad. One of the easiest species to recognize by its slender smooth stems with the light crown usually at a considerable distance above the ground and its lemon-scented foliage. The timber is strong and flexible, being used for shafts, axe-handles, &c. In places where the winters are damp and cold it is difficult to grow from seed and to establish when planted out. Seedlings are particularly liable to damp off during the monsoon. Once established the height growth is fast, 5-8 feet annually. It reaches 100 feet in height but the diameter growth is rather poor and I have not seen a specimen 6 feet in girth. It stands a heavy rainfall better than most species but is sensitive to frost at 4,000 feet. Owing to the slow growth in diameter and difficulty in growing seedlings as compared with other members of the genus it cannot be recommended for forest planting. This plant is a lemon-scented variety of *E. maculata*, Hook., but it is convenient to treat it as a separate species as *E. maculata* has been tried in Lahore but without success, the seedlings being exceedingly susceptible to damp. Flowers: February—March.

10. *EUCALYPTUS GLOBULUS*, Labill. Voy. I (1799) p. 153, t. 13.—A gigantic tree, bark smooth peeling off in long strips which often remain hanging on the stem or branches. Leaves 8-10 inches long, falcate, curved, rather thick, those of seedlings sessile, opposite, horizontal, broadly ovate, very glaucous, with a bluish hue. Flowers large, axillary, 1-3 together, nearly sessile. Operculum thick, warty, low, abruptly pointed. Anthers opening by slits. Fruits 7-1 inch diameter, warty, angular, valves exserted. *Blue Gum*.

Indigenous to Tasmania, Victoria and the mountains of New South Wales where it reaches a height of 200-300 feet. The best known of all the genus and in consequence the species first tried in the Punjab in 1860. The behavior is peculiar, for a time in the plains plants grow well and often very rapidly but sooner or later, usually in the first monsoon but sometimes not for 2 or 3 years they suddenly die from no apparent cause. Brandis quoting from a memorandum on Eucalyptus written in 1874 says "The data recorded in that note showed conclusively that *E. globulus* does not thrive in the plains of Northern India, though it may live and even grow rapidly for a few years it invariably dies" (*Indian Forester*, VII, p. 136.) It has been tried almost every year since then but always with the same result. I have never seen a tree more than 3 or 4 years old below 4,000 feet. Previous to the big frost in 1905 *E. globulus* was much grown in Abbottabad and a few large specimens are still left all more or less badly damaged by frost. Even in Abbottabad

however conditions are not really favorable for *E. globulus* and of a considerable number of plants planted since the frost the best had only attained a height of 12 feet in 4 years, a size which *E. tereticornis* would have reached in 18 months. *E. globulus* may also be seen in Kulu, Bashahr and the Simla District between 4,000 and 7,000 feet; at the higher elevations it suffers from snowbreak in common with most other species of the genus. Flowers: March.

11. *EUCALYPTUS SALIGNA*, Sm. in *Trans. Linn. Soc.* III (1797) p. 285.—A tall tree with straight stem and smooth silvery-grey shining bark, commonly dark colored and somewhat roughish for a few feet near the base. Leaves 4-6 inches long, only slightly falcate, lateral nerves numerous, fine, paler beneath. Umbels axillary, 4-8-flowered, peduncles flattened. Calyx-tube sessile or nearly so. Operculum conical, about equalling the calyx-tube. Anthers opening by parallel slits. Fruits .25 inch diameter, not contracted at the mouth, rim prolonged a little above the bases of the valves leaving a narrow space between the valves and the rim of the fruit, valves exserted. *N. S. W. Blue Gum* or *Flooded Gum*.

Indigenous to New South Wales and Queensland on or near the coast. Cultivated in Amritsar where it grows well. A well-shaped fast-growing species yielding a timber useful for planking and building but not durable. Flowers: May.

12. *EUCALYPTUS TERETICORNIS*, Sm. in *Bot. N. Holl.* (1793) p. 41.—A large tree usually with an erect trunk and smooth ash-colored stem. Leaves 6-8 inches long or longer, usually falcate but often mixed with shorter ovate leaves, those of seedlings ovate. Flowers in axillary 4-8-flowered umbels. Calyx-tube turbinate on a short rather stout pedicel. Operculum conical, exceeding the calyx-tube, usually .5 inch long. Anthers opening by slits. Fruits about .25 inch diameter, rim convex, valves prominently exserted. *Forest Red Gum*.

Indigenous to Eastern Australia from Victoria to Queensland extending far into the interior and also to New Guinea. Cultivated in the plains and hills up to 4,000 or 5,000 feet. The commonest eucalypt in the Punjab and with the possible exception of *E. rudis* the fastest in growth. Three trees in Hoshiarpur 15-16 years old averaged 115 feet in height by 5 feet 4 inches in girth. A tree on poor gravelly soil near Haripur, Hazara, 6 years from seed measured 30 feet in height and 2 feet 5 inches in girth. The growth from coppice is still more rapid, in Abbottabad shoots reach 15 feet by 7½ inches in one year and 32 feet by 15 inches in four years. The timber is very hard, heavy and durable but warps and cracks badly in seasoning. It would be useful for posts, &c., and is apparently not eaten by white ants. The largest trees in Australia are said to be 100-120 feet high by 3-4 feet in diameter and there are trees fully this size in the Punjab. It yields an excellent fire-wood. Some forms approach *E. rostrata* very closely but have shorter and stouter pedicels and the operculum is not beaked, as a rule the operculum is very much longer than in *E. rostrata*. It was severely damaged by frost in Abbottabad in 1905 but not so much as *E. globulus* or many of the indigenous trees and at 3,000 feet it was quite unharmed. Flowers: January—April.

13. *EUCALYPTUS ROSTRATA*, Schl. in *Linnaea* XX (1847) p. 655.—A large tree usually not so straight as *E. tereticornis*, bark smooth, white or ashy, sometimes more or less rough on the stem but smooth on the branches. Leaves 4-6 inches long, more or less falcate, rather uniform in size, those of seedlings usually narrow-lanceolate. Flowers in axillary 3-12-flowered umbels, peduncle and pedicels rather slender. Operculum hemispheric, beaked, not exceeding the calyx-tube. Anthers opening by parallel slits. Fruits about .25 inch diameter, on slender conspicuous stalks, rim convex, valves prominently exserted. *Red Gum*.

Indigenous to all the states of Australia mainly inland. Cultivated commonly in the plains. In rate of growth, quality of timber and requirements it is very close to *E. tereticornis*, which it often closely resembles,—*vide* the note under that species. There are specimens 10-12 feet in girth and over 100 feet high in various places in the Punjab. Flowers : May—June.

XLII. MELASTOMACEÆ.

Herbs or shrubs, rarely trees. Leaves opposite (rarely whorled), simple, exstipulate, often longitudinally nerved. Flowers usually bisexual, regular, usually 4-5-merous, often showy. Calyx-tube free or more or less adnate to the ovary by longitudinal septa ; limb truncate, 3-6-lobed or calyptrate. Petals free, almost always twisted to the right in bud, inserted on the margin of the calyx-limb. Stamens usually twice as many as the petals, 1-seriate, inserted with the petals, filaments bent inwards in bud, anthers usually opening by 1 or 2 terminal pores. Ovary usually 3-6-celled ; ovules usually numerous ; style simple, filiform. Fruit included in the calyx-tube, capsular or baccate, breaking up irregularly or by splits through the top of its cells. **DISTRIB.** A large tropical family, very numerous in America.

OSBECKIA, Linn.

(In honor of Peter Osbeck, a Swedish botanist and traveller of the 18th century. **DISTRIB.** Species 50 ; tropics of the old world.)

OSBECKIA STELLATA, Wall. Cat. (1828) No. 4062.—An erect shrub 4-6 feet high, branches bristly with short adpressed rigid hairs. Leaves opposite, 3-6 by 1-2.5 inches, lanceolate or elliptic, entire, acuminate, clothed above and on the nerves beneath with rather scattered short stout bristly hairs, membranous, longitudinally 5-nerved ; petioles .5-1 inch long, bristly. Flowers 2-2.5 inches across, pink-purple, in few-flowered terminal clusters ; bracts .2-.3 inch long, ovate, bristly, ciliate. Calyx 1 inch long, densely clothed with matted stellate bristles ; tube ovoid, partly adnate to the ovary ; lobes usually 4, linear-lanceolate, nearly as long as the tube, alternating with smaller linear-subulate lobes, all deciduous after flowering. Petals usually 4. Stamens usually 8 ; anthers .5-.6 inch long, yellow, curved, longer than the filaments, attenuate upwards, dehiscent by terminal pores, connectives tubercled at the base. Ovary usually 4-celled, enclosed within and partially adnate to the calyx-tube, setose at the free apex ; ovules many, axile ; style long. Capsule .5-.7 inch long, ovoid-oblong, opening at the top by pores, included in the calyx-tube which is densely bristly, contracted at the neck and produced beyond the capsule. Seeds minute. Collett, Fl. Siml. fig. 56.

Outer Himalaya from the Ravi eastwards ascending to 5,000 feet. Not common but occurs in Kangra and Simla Districts. Also near Takleeh in Bashahr. A very handsome plant in flower. Flowers: September.

OSBECKIA CHINENSIS, Linn.—A herbaceous plant, also occurs in the Kangra district. It has smaller leaves and flowers. The calyx-tube is glabrous or has a few adpressed pectinate scales.

XLIII. LYTHRACEÆ.

Trees, shrubs or herbs. Leaves usually opposite, entire, stipules 0 or minute. Flowers bisexual, usually regular, cymose or paniculate. Calyx usually free, persistent, 3-6-lobed or -toothed, valvate, sometimes with smaller intermediate teeth. Petals usually as many as calyx-lobes rarely fewer, imbricate and crumpled in bud, sometimes wanting. Stamens definite or indefinite, inserted on the calyx-tube, filaments bent inwards in bud. Ovary superior, rarely inferior, 1-6-celled; ovules many; style usually filiform; stigma capitate, rarely 2-lobed. Fruit capsular or baccate, membranous or coriaceous, girt round the base by the calyx or included in or surmounted by it, variously dehiscent or rarely indehiscent. **DISTRIB.** A family mainly tropical and largely American.

Usually thorny; leaves pellucid-punctate;
ovary inferior 1. *Punica*.

Unarmed; leaves with minute black
dots beneath; ovary superior ... 2. *Woodfordia*.

1. *PUNICA*, Linn.

(From *Malum Punicum*, the name used by Pliny. **DISTRIB.** Species 2, one in Sokotra and the following.)

PUNICA GRANATUM, Linn. *Sp. Pl.* (1753) p. 472.—A large deciduous shrub or small tree, bark smooth, grey, thin; often armed with small axillary or terminal thorns. Leaves opposite, 1-2.5 inches long, oblong-lanceolate, oblong-elliptic or oblong-oblancheolate, glabrous, entire, minutely pellucid-punctate, shining above, bright-green beneath, base narrowed into a very short petiole. Flowers 1.5-2 inches long and as much across, mostly solitary, sometimes 2-4 together, terminating short shoots, sometimes apparently axillary, sessile or nearly so. Calyx-tube campanulate, adnate to and produced beyond the ovary, coriaceous, lobes 5-7, valvate. Petals 5-7, obovate, scarlet, wrinkled, inserted between the calyx-lobes. Stamens very numerous, inserted on the calyx below the petals at various levels; anthers elliptic, dehiscing longitudinally. Ovary inferior, many-celled, the cells arranged in 2 concentric circles; style long, bent; stigma capitate. Carpels early coalescing and owing to unequal growth becoming arranged into two tiers, 3 in the lower and 5-9 in the upper.

Fruit 1.5-3 inches diameter, globose, tipped with the calyx-limb, rind coriaceous, woody, the interior septate with the membranous walls of the carpels each carpel containing numerous seeds angular from mutual pressure. Seeds with a watery outer coat containing pink juice and a horny inner coat. *Pomegranate*. Vern. *Anár*; *daruni*.

Wild in the Salt Range and Himalaya 3-6,000 feet. Common and gregarious on dry limestone soils in Hazara but becoming scarce further east and probably in many places not indigenous. Usually a shrub but sometimes a tree 20 feet high and 3-4 feet in girth. The wood is used for firewood but is not good for the purpose. The fruit is eaten and some of the cultivated varieties are very large. The bark of the root is used as a remedy for tape-worm. Flowers mainly in April and May.

2. WOODFORDIA, Salisb.

(In honor of J. Woodford, a British botanist of the 19th century. DISTRIB. Species 2, one in Abyssinia and the following.)

WOODFORDIA FLORIBUNDA, *Salisb. Parad. Lond.* (1806) t. 42.—An evergreen shrub, branches long spreading, bark peeling off in thin fibrous strips. Leaves opposite or in whorls of three, 2-4 by .8-1.5 inches, lanceolate, oblong-lanceolate or ovate-lanceolate, usually acuminate, base rounded or cordate, glabrous above when mature and with scattered black glandular dots, pale and more or less pubescent on the nerves beneath with numerous black dots, lateral nerves 6-12 pairs, prominent beneath and joined by intramarginal veins; petiole 0. Flowers about .7 inch long to the ends of the stamens, red, in dense axillary paniculate cymose clusters. Calyx tubular, .3-.5 inch long, red, slightly curved and widened at the mouth which is oblique and has 6 deltoid lobes .05 inch long, alternating with 6 smaller accessory teeth, persistent in fruit. Petals 6, red, scarcely exceeding the calyx-teeth. Stamens 12, inserted near the base of the calyx-tube, much exserted, filaments red. Ovary free, 2-celled, oblong; ovules numerous, axile; style filiform, exserted. Fruit a capsule, very thin, splitting irregularly, enclosed within the calyx-tube which is expanded and split in the lower portion. Seeds many, minute. Collett, *Fl. Siml.*, fig. 57. Vern. *Dh noi*.

Sub-Himalayan tract and Himalaya ascending to 5,000 feet. Common. A handsome plant when in flower and sometimes cultivated. The flowers give a red dye used for dyeing silk. Flowers: February—April.

LAGERSTREEMIA, *Linn.*—Trees or shrubs. Leaves opposite or nearly so. Flowers usually showy, in axillary and terminal panicles. Calyx-tube campanulate, coriaceous, smooth, ribbed or winged, lobes usually 6, ovate or triangular, often caudate, valvate. Petals usually 6, inserted between the calyx-lobes, clawed, limb more or less orbicular, wrinkled, the margin crisped. Stamens indefinite, inserted near the bottom of the calyx-tube; filaments much exserted. Ovary 3-6-celled, sessile at the bottom of the calyx-tube; ovules many, axile;

style long, bent; stigma capitate. Capsule girt by the persistent calyx, loculicidally 3-6-valved. Seeds compressed, winged at the top.

LAGERSTRÆMIA INDICA, *Linn.*—A large deciduous shrub or small tree 15-20 feet high. Leaves 1·5-2 inches long, elliptic, sessile, obtuse. Flowers 2 inches across, varying from white to rose or purple. Calyx-tube smooth. Capsule ½ by ¼ inch, coriaceous.

Indigenous to China. Frequently planted in gardens in the plains and in the hills. Usually propagated by suckers or cuttings. Flowers: May—August.

LAGERSTRÆMIA FLOS-REGINÆ, *Retz.*—A large deciduous tree. Leaves 4-8 by 1·5-3 inches, oblong-lanceolate or elliptic-oblong, acute or abruptly short-acuminate; petioles 2-3 inch long. Flowers 2-3 inches across, purple. Calyx-tube prominently ribbed. Capsule 7-12 by 6-1 inch, rather woody.

Indigenous to Assam and South India. Frequently grown in gardens in the plains. The timber is used for many purposes in Assam. Flowers: May—July.

LAWSONIA INERMIS, *Linn.*—A glabrous shrub, twigs quadrangular often ending in a thorn. Leaves opposite, 5-12 by 2-6 inch, elliptic, rhomboid or broadly lanceolate, acute or obtuse, often mucronate, base tapering, petioles 0 or very short. Flowers 3 inch across, white, creamy or rosy, in large terminal pyramidal panicles. Calyx broadly campanulate, lobes 4, ovate, acute, 1 inch long. Petals 4, shortly clawed, inserted between the calyx-lobes, limb suborbicular. Stamens 8, inserted in pairs at the base of the calyx-tube, opposite the calyx-lobes. Ovary 2-4-celled; ovules many, axile; style thick; stigma capitate. Capsule 2-3 inch diameter, depressed-globose, supported by the persistent calyx and tipped with the style. *L. alba*, Lamk. Fl. Brit. Ind., II, p. 573. Vern. *Mendhi*.

The *henna*, probably a native of Persia. Widely cultivated in the plains of the Punjab. The leaves are used by natives for dyeing the nails, skin and beard. Makes a good hedge. Flowers: June.

XLIV. SAMYDACEÆ.

Trees or shrubs. Leaves usually alternate and distichous, often pellucid-punctate, stipules small or 0. Flowers regular, usually bisexual. Calyx coriaceous, persistent, tube short or long, rarely adnate to the ovary; lobes 3-7, imbricate or valvate. Petals as many as calyx-lobes, rarely more, sometimes wanting, perigynous, imbricate. Stamens definite or indefinite, 1-many-seriate, often alternating with staminodes, equidistant or in bundles opposite the petals; filaments filiform or capillary, free or connate at the base only or throughout their entire length; anthers dehiscing longitudinally. Ovary free or rarely adnate to the calyx-tube, sessile, 1-celled; ovules many or few, on 2-5, usually 3, parietal placentas; style 1, entire or 3-fid or styles 2-5. Fruit capsular or rarely indehiscent, 1-celled, 1-many-seeded, 2-5-, usually 3-valved at the apex or throughout its entire length, the valves alternating with the placentas. Seeds usually few, often arillate. **DISTRIB.** A small family of the warm r parts of the world.

CASEARIA, Jacq.

(In honor of Johann Casearius, a Dutch Missionary in Cochin China and a botanical author of the 17th century.)

Shrubs or small trees. Leaves alternate, distichous, pellucid-punctate with rod-like or orbicular resin-cavities; stipules small, caducous. Flowers small, in axillary clusters; pedicels jointed above the base. Calyx inferior, deeply 4-5-lobed, lobes obtuse, imbricate, persistent. Petals 0. Stamens 6-15, rarely more, alternating with as many staminodes; filaments free or connate into a ring at the base. Ovary free, ovules many; style short; stigma capitate or 3-fid. Capsule succulent, globose or ellipsoid, when dry 3-angular or 6-ribbed, usually 3-valved. Seeds arillate. **DISTRIB.** Species 80; the warmer parts of the world, most abundant in America.

Leaves glabrous, stipules .5 inch long ... 1. *C. graveolens*.

Leaves tomentose; stipules minute ... 2. *C. tomentosa*.

1. *CASEARIA GRAVEOLENS*, Dalz. in *Kew Journ. Bot.* IV (1852) p. 107.—A small deciduous tree, branches long, horizontal, glabrous, bark dark-grey with few longitudinal wrinkles. Leaves 3.5-8 by 1.5-4 inches, broadly elliptic, obtuse or shortly acuminate, more or less crenate-serrate, glabrous, lateral nerves 8-12 pairs; petiole .2-.5 inch long; stipules about .5 inch long, lanceolate-subulate, caducous. Flowers .2 inch diameter, green, with a disagreeable odor, in clusters in the axils of the fallen leaves; pedicels short. Calyx deeply 5-lobed, lobes oblong, concave, obtuse, pubescent outside. Stamens 8 (6-10), alternating with villous staminodes. Style .06 inch long; stigma discoid. Fruit .7 inch long, ellipsoid, yellow. Aril orange. *C. glomerata*, Roxb. Vern. *Chilla*.

Sub-Himalayan tract from the Chenab eastwards. Not nearly as common as the following species. The wood is light-yellow, even-grained and fairly hard. The leaves turn copper-colored in January. Flowers: May—June.

2. *CASEARIA TOMENTOSA*, Roxb. *Fl. Ind.* II (1832) p. 421.—A small deciduous tree, branches horizontal, tomentose, bark dark-brown on old stems, exfoliating in square flakes. Leaves 2.5-7 by 1.5-2.7 inches, oblong or the smaller ovate or elliptic, acute, more or less serrulate or sometimes almost entire, tomentose especially on the nerves beneath, lateral nerves 8-10 pairs; petioles .3-.5 inch long; stipules minute, caducous. Flowers .2 inch across, greenish-yellow, in dense axillary clusters. Calyx deeply 4-5-cleft; lobes broadly elliptic, obtuse, pubescent outside. Stamens 8 (6-10), alternating with short clavate staminodes, villous at the apex. Style .03 inch long; stigma sub-globose, faintly lobed. Fruit .7 inch long, ellip-

soid, green. Seeds embedded in a scarlet pulp consisting of the agglomerated arils. Collett, Fl. Siml., fig. 59. Vern. *Chilla*.

Sub-Himalayan tract from the Indus eastwards. Common in waste places and open scrub jungles. Wood dirty-white or yellowish, compact, even-grained, it is not used except for fuel. The leaves are not liked by cattle or goats. The foliage turns red before falling. Flowers: March—May.

XLV. CACTACEÆ.

Succulent plants, the stem very various in form, very rarely with well-developed leaves, the leaves usually reduced to small scales in the axils of which is an area (*areole*) bearing a tuft of hairs and often prickles and bristles with barbed hairs (*glochidia*). Flowers showy, bisexual, usually regular, rarely zygomorphic, usually solitary and springing from the areoles, sometimes from between tubercles on the stem, rarely panicled. Sepals and petals not sharply differentiated, usually of numerous segments forming a perianth which is usually united and tubular at the base; limb salver-shaped, funnel-shaped or rotate. Stamens almost always very numerous, arising from the perianth-tube, rarely from the receptacle. Ovary inferior, 1-celled; ovules usually very numerous on projecting parietal placentas; style 1; stigmas as many as the placentas, stellately spreading. Fruit a 1-celled more or less fleshy berry, very rarely dehiscent or in one species a circumsciss capsule. **DISTRIB.** A fairly large family confined to America with the exception of one genus which was probably transported to Africa by birds in comparatively recent times, one species having extended as far as Ceylon.

The Cactaceæ contains a number of plants with edible fruits which are cultivated for their fruits by the Indians in Mexico. The most important species being *Cereus triangularis*, Haw., *C. eburneus*, Salm-Dyck, *C. giganteus*, Engl., *C. Thurberi*, Engl., and *Opuntia Ficus-Indica*, Mill. The last-named species is cultivated for its fruits in most warm dry countries and has recently been introduced into Lahore. It should perhaps be called *O. decumana*, Haw., but is the *O. Ficus-Indica* of most authors.

Several species of the genus *Opuntia* are naturalized in India and attempts have been made to utilize them as fodder for cattle in times of scarcity. For this purpose the joints are scorched to burn off the prickles, then cut up and fed to the cattle with cotton-seed cake or some other more concentrated food. The results are apparently satisfactory, *vide Agric. Journ. Ind.*, IX, 2, p. 190-196 (1914).

The cochineal insect, a coccid which yields a red dye formerly used for coloring sweetmeats and puddings, was at one time cultivated but the coloring matter has since been replaced by aniline dyes. The insect feeds on some species of *Opuntia*, e. g., *O. coccinellifera*, Mill. and *O. monacantha*, Haw., but not on all. It is capable of killing the plant on which it feeds and about 1907-1909 it almost exterminated *O. monacantha* in Kangra and Hazara. This insect is *Coccus indicus*, Green, known as the *Wild Cochineal*: as a source of coloring matter it is inferior to the true cochineal, *Coccus cacti*, Linn.

OPUNTIA, Mill.—(The Prickly Pears).

(From Opus, a city of Loeris where some species grow plentifully.)

Erect shrubs with jointed flattened stems (in the naturalized species). Leaves very small, subulate, caducous. Flowers regular, yellow or red, solitary, sessile from the areoles. Perianth-segments very numerous, free, erect or spreading. Fruit fleshy. Seeds pale with a bony shell. **DISTRIB.** Species about 150; from Canada to Patagonia, several naturalized in all warm regions.

All species flower during the hot weather. Vern. *Kabuli tsui, gangichu, chitta thor, nagphani.*

Not prickly; perianth-segments erect; style and stamens much exceeding the perianth ... 1. *O. coccinellifera.*

Usually prickly; perianth-segments spreading; style and stamens not exceeding the perianth.

Joints bright grass-green, prickles in tufts of 1-few on young joints increasing up to 10 on older stems ... 2. *O. monacantha.*

Joints dull bluish or greyish green.

Joints about 2·5 inches wide, usually without prickles, sometimes the prickles present in tufts of 1-3 ... 3. *O. stricta.*

Joints 6-8 inches wide, prickles in tufts of about 4-6.

The largest prickles stout, subulate, usually curved, horny; joints undulate ... 4. *O. Dillenii.*

Prickles slender, straight, grey and opaque except when young; joints not undulate 5. *O. nigricans.*

1. **OPUNTIA COCCINELLIFERA, Mill.** *Gard. Dict. ed. 8* (1768) No. 6.—Arborescent or shrubby, 10 feet high, stem 8 inches diameter. Leaves 3-5 inch long, curved, thick, blunt. Joints 10 inches long by 5 inches broad, oblong or oblanceolate, blunt, rather thick. Areoles usually without prickles, glochidia inconspicuous. Flowers about 2·5 inches long, red. Perianth campanulate, the outer segments short green. Stamens much exceeding the perianth; filaments pinkish-red; anthers yellow. Style exceeding the stamens; stigmas erectopatent. Berry ellipsoid, 2 inches long, 1·2 inches diameter, red. *Burkill, Rec. Bot. Surv. Ind., IV, p. 287-322.*

Probably indigenous to Mexico. Introduced as a food-plant for the Cochineal insect. Not common in the Punjab but found in the Hoshiarpur District (fide *Burkill*.) Grown occasionally in gardens, e.g., Lahore.

2. **OPUNTIA MONACANTHA, Haw.** *Suppl. Pl. Succ.* (1819) p. 81.—Shrubby, branched from the base, 6-8 feet high. Leaves dark-brown, slightly recurved, 2·5 inch long. Joints usually 12 by 3-4 inches variable in size and shape, sometimes 2·5 feet long, narrow-oblong to broad-obovate, rather thin, bright grass-green. Areoles at first with 1 prickles or with few of which

one is larger than the others, as the joints become older the number of prickles in each tuft increases up to 10; prickles straight, up to 2 inches long; glochidia numerous. Flowers 2.2-5 inches long, 3 inches across, yellow. Perianth rotate, the outer segments short, ovate-acute, green, the inner spatulate, acute, denticulate. Stamens half as long as the inner perianth segments. Style exceeding the stamens, stigmas 5. Berry pyriform, truncate and deeply depressed at the apex, bearing tufts of glochidia on the outside, reddish when ripe, *O. monacantha*, *Burkill. l. c. ex parte*.

Indigenous to Brazil and the Argentine. This species appears to have been established in the Punjab longer than any of the others and is the only one which has obtained a footing in the Sub-Himalayan tract where it is found as far west as the Indus and ascends to 4,000 feet. It is common in Kangra. It is kept in check by the wild cochineal insect which periodically destroys it over large areas. Spreads by means of the joints getting detached and scattered. The fruits appear to ripen fully but on falling off they take root as a whole just as do the joints. Seed reproduction if it occurs at all, is of no importance in spreading this species or any of the *Opuntias* mentioned. In the plains it is widely distributed but less common than other species.

3. *OPUNTIA STRICTA*, *Haw. Syn. Pl. Succ.* (1812) p. 191.—Shrubby, branched from the base, about 4 feet high. Leaves .1-.15 inch long, conical, green or reddish. Joints about 6 by 2.5 inches, very uniform in size and shape, elliptic-oblong, narrowed at both ends, thick, dull greyish-green. Areoles usually without prickles, occasionally with 1, rarely 2 or 3 straight prickles about 1 inch long, glochidia numerous, reddish-brown. Flowers 3 inches across, yellow. Perianth rotate, the outer segments short, acute, green, the inner spatulate, acute. Stamens half as long as the inner perianth segments. Style exceeding the stamens: stigmas 6. Berry turbinate, depressed at the apex, slightly warty, bearing scattered tufts of glochidia, dull carmine when ripe. *O. monacantha*, *Burkill, l. c., ex parte*.

Indigenous to South America. The commonest species in the Central Punjab between the Sutlej and Ravi; less common than other species elsewhere. Frequently planted in hedges. The fruits ripen but reproduction by seed rarely occurs, the whole fruit on dropping to the ground takes root as in the case of *O. monacantha*. This plant or a closely allied species has spread over extensive areas in Queensland and is one of the main "Pest Pears" in that country. In the Punjab however its rate of spreading is too slow for it to be likely to become a serious nuisance apart from which the country is sufficiently thickly inhabited to keep it in check. It is likely to be of use in reclothing dry arid hills such as the Pabbi and has been employed for clothing some of the brick-kiln mounds in Lahore.

4. *OPUNTIA DILLENII*, *Haw. Suppl. Pl. Succ.* (1819) p. 79.—Shrubby, branched from the base, about 5 feet high. Leaves .15 inch long, pale-green, conical from a broad base. Joints 12-16 by 6-8 inches, broadly obovate, undulate, not very thick, dull bluish-green. Areoles large, bearing 4-6 prickles,

the largest very stout, subulate, firm and sharp, 1-1.5 inches long, usually somewhat curved and of a horny appearance; glochidia numerous about .5 inch long, yellowish. Flowers 3 inches across, yellow tinged with orange. Perianth rotate, the outer segments ovate, acute, rounded, with membranous margins, the inner obovate, rounded, mucronate. Stamens of unequal lengths, scarcely reaching half the length of the inner perianth segments. Style stout, exceeding the stamens; stigmas 5-8, erect. Berry pyriform, truncate, depressed at the apex, often angular or warty when not full ripening, bearing tufts of glochidia, deep reddish-purple when ripe.

Probably indigenous to Mexico. Apparently an early introduction in the Punjab as it is found in the plains as far west as Rawalpindi. Commoner in the East than in the West Punjab especially near Delhi where it is found on the Ridge. According to Schumann, *Gesamt Beschreibung der Kakteen*, this species should be called *O. Tuna*, Mill.

5. *OPUNTIA NIGRICANS*, *Haw. Syn. Pl. Succ.* (1812) p. 189.—Subarborescent or shrubby, 10 feet high or more. Leaves .3 inch long, subulate, recurved, reddish at the tips. Joints variable in size, about 7-12 by 4-7 inches, obovate or elliptic, rather thin, not undulate, dull bluish-green. Areoles bearing about 4-5 increasing up to 10, rather slender straight prickles which are grey and opaque except when quite young, the largest 1.2-2 inches long; glochidia inconspicuous, almost hidden amongst woolly hairs, rusty-brown. Flowers 2 inches across, yellow or orange. Perianth rotate, the outer segments short, ovate, acute, red in the centre, yellow at the edges, the inner spatulate, acute. Stamens a little shorter than the perianth. Style exceeding the stamens; stigmas 6. Berry pyriform, angular or more or less warty, bearing tufts of glochidia and occasionally a few prickles, reddish-purple when ripe. *O. nigricans* and *O. elatior*, *Burkill, l.c.*

Probably indigenous to Mexico. Found in the South-East Punjab. Abundant on the ridge at Delhi.

Several other species of *Opuntia* are to be seen in gardens as well as many plants belonging to other genera of the family. The only two worth mentioning belong to the genus *Cereus* which is recognized by angular or ribbed branches or stems and large funnel-shaped flowers.

CEREUS PTEROGONUS, *Lemaire* (vide *Burkill*). Erect, arboreus, 12-15 feet high, branches erect, parallel, dull bluish-green, 4-7-ribbed, later becoming angular and finally rounded. Ribs compressed, undulate, 1.2 inches high, bearing areoles .7-1 inch apart. Prickles at first about 8 in each tuft increasing to about 20. Flowers white, about 7 inches long.

Indigenous to Tropical America. Grown in hedges in and around Anandpur, District Hoshiarpur, cultivated in gardens in Lahore, &c. It makes an excellent hedge much superior to any *Opuntia* hedge.

CEREUS TRIANGULARIS, *Haw.*—A succulent climber climbing by adventitious roots. Branches 1.5 inches thick, 3-angled, the angles undulate with the

areoles in the depressions. Prickles in tufts of 3-5, about 15 inch long. Flowers white, 10 inches long, 5 inches across, very fragrant, opening at night. Fruit 4 inches long, ovoid, edible.

Probably indigenous to Mexico. Grown in gardens in the plains for its flowers. This plant as already mentioned has good fruits and in some countries it is cultivated for its fruits. I have never seen it fruit in India perhaps owing to it being grown as a single specimen so that cross fertilization which appears to be necessary for the production of fruits in many of the *Cactaceæ*, is impossible. Flowers during the rains.

XLVI. ARALIACEÆ.

Trees or shrubs, sometimes climbing, rarely herbs. Leaves alternate, rarely opposite or whorled, simple, compound or decomposed; petioles long, usually with broad sheathing bases; stipules within or partly adnate to the petiole. Flowers regular, bisexual or polygamous, usually small, often in conspicuous inflorescences composed of umbels, heads, racemes or spikes. Calyx-tube adnate to the ovary; limb annular, cup-shaped, truncate or more or less obscurely toothed, or obsolete. Petals usually 5, valvate or slightly imbricate, deciduous singly or as a calyptra, rarely persistent. Stamens as many as and alternating with the petals, rarely more, inserted with them within the margin of the calyx around an epigynous disk. Ovary inferior, 1-many-celled; ovules solitary in each cell, pendulous; styles as many as cells to the ovary, free or united, erect or recurved. Fruit usually baccate or dry, cells and seeds as many as the cells of the ovary. **DISTRIB.** A family mainly tropical and sub-tropical.

Leaves simple; petals valvate ...	... 1. <i>Hedera</i> .
Leaves digitate; petals valvate ...	... 2. <i>Heptapleurum</i> .
Leaves pinnate; petals imbricate ...	... 3. <i>Pentapanax</i> .

1. *HEDERA*, Linn. (The Ivy.)

(The classical name for the Ivy. **DISTRIB.** Species 1; Europe, North Africa and Temperate Asia.)

HEDERA HELIX, Linn. *Sp. Pl.* (1753) p. 202.—An evergreen shrub climbing by means of adventitious roots over trees and rocks. Leaves alternate, very variable, on flowering shoots 2-4 inches long, usually not lobed, very variable in breadth, base usually narrowed, on sterile shoots usually with 1-5 pairs of lobes and usually cordate bases, all coriaceous, glabrous; petioles slender, .5-5 inches long; stipules 0. Flowers .3 inch across, polygamous, yellowish-green, in globose pedunculate umbels; umbels terminal, solitary or 2-6 in corymbs; peduncles and pedicels clothed with minute stellate scales, the pedicels .4 inch long or sometimes longer at low elevations. Calyx-limb obsolete. Petals 5, .1 inch long, triangular, valvate. Stamens 5. Disk low-conical. Ovary 5-celled; styles united into a very

short column. Berry .3 inch diameter, globose, yellow, rarely red, exocarp fleshy, pyrenes thin-walled, smooth. Seeds 5 or fewer by abortion. *H. himalaica*, *Tobler*, *Die Gattung Hedera* (1912) pp. 67-79. *Ivy*. Vern. Banbathkari (Rp.), *har-banbal* (Haz.), *kermi* (Ku).

Himalaya 2-10,000 feet; Salt Range. Common. The Himalayan Ivy differs from the common *H. Helix* of Europe somewhat in foliage, in the stellate hairs or scales on the inflorescence having more branches (15-18 against 6-7) and in the color of the fruit (black in *H. Helix* of Europe). For this reason *Tobler l. c.* considers it specifically different. He recognizes 6 species in the genus. Flowers: September, October or later at low elevations.

2. HEPTAPLEURUM, Gaertn.

(From the Greek, *hepta*, seven, and *pleuron*, a rib referring to the fruit. **DISTRIB.** Species about 60; tropics of the Old World.)

HEPTAPLEURUM VENULOSUM, *Seem. Journ. Bot.* III (1865) p. 80.—A glabrous evergreen climbing shrub, climbing by adventitious roots. Leaves alternate, digitate; petiole 6-9 inches long, dilated and clasping at the base; stipules .3-.5 inch long, connate, between the petiole and the stem. Leaflets 3-7 usually 5, 4-8 by 2-3.5 inches, the middle one largest, elliptic-oblong, acuminate, entire, glabrous, coriaceous, shining above; petiolules .5-2 inches long, jointed to the blade. Flowers .2 inch diameter, cream-colored, polygamous, in small globose umbels, racemously arranged on the branches of a terminal panicle, branches of the panicle 5-8 inches long, purple; peduncles of the umbels .5 inch long; pedicels .1-.3 inch long; bracts caducous, woolly, enclosing the umbels in early bud. Calyx truncate. Petals 5, valvate, obovate-oblong, acute. Stamens 5. Disk conical. Ovary 5-celled; stigmas sessile on the conical disk. Berry .3-.4 inch diameter, globose, yellow, 5-ridged when dry, 5-celled.

Along the foot of the Himalaya ascending to 4,000 feet. Not common in the Punjab. I have only seen it in the Sutlej Valley near Jhakri. Cultivated in Lahore. Flowers: January—February.

3. PENTAPANAX, Seem.

(From the Greek, *penta*, five, and *Panax*, a genus of this family; referring to the 5-merous flowers, whereas in *Panax* the ovary is 2-celled. **DISTRIB.** Species 5-6; mostly Indian.)

PENTAPANAX PARASITICUM, *Seem. Rev. Heder.* (1868) p. 22.—A shrub climbing by means of adventitious roots. Leaves 4-10 inches long, imparipinnate, petiole slender not dilated at the base, rachis jointed at the insertion of the leaflets. Leaflets 5, 2-4 by 1-2 inches, ovate or ovate-lanceolate, entire, acuminate, base rounded often unequal, subcoriaceous, glabrous beneath; petiolules 0-.1 inch long; stipules small. Flowers .2 inch across, greenish, polygamous, in globose pedunculate um-

bels, which are terminal solitary or 2-8 in a small panicle; peduncle of the umbels .5-2 inches long; pedicels .3-.5 inch long, slender, expanded into a minute calyculus close below and jointed to the flower. Calyx-teeth 5. Petals 5, imbricate, broad, obtuse. Stamens 5. Disk minutely 10-lobed, convex in fertile flowers. Ovary 5-celled; styles united to the summit. Fruit small, subglobose, obscurely 5-angled.

Himalaya 7,500-9,000 feet, not common in the Punjab. I have only collected it once in the Deval Nalla, Palampar Tahsil, Kangra, where it was found climbing up spruce trees. Flowers: October.

ARALIA CACHEMIRICA, *Dene.*—A large herb. Leaves pinnately compound. Leaflets 3-6 by 1.5-3 inches, ovate-oblong, serrate. Flowers small, white, in numerous paniced or racemed umbels. *Collett, Fl. Siml., fig. 66.*

Himalaya 8-12,000 feet. Common in forest undergrowth.

BRASSAIA ACTINOPHYLLA, *Endl.*—An evergreen tree with short stem and long stout little-branched ascending shoots. Leaves crowded near the ends of the shoots, digitate, leaflets 7-16.

Indigenous to Queensland. Cultivated occasionally in gardens.

XLVII. CORNACEÆ.

Shrubs or trees. Leaves opposite or alternate, entire or sometimes angularly lobed or serrate; stipules 0. Flowers regular, bisexual or unisexual, in cymes, panicles or heads. Calyx-tube adnate to the ovary; limb 0 or truncate or 4-10-toothed, persistent, valvate or open in bud. Petals 0 or 4-5, rarely many, imbricate or valvate. Stamens inserted with the petals at the base of an epigynous disk, usually as many as, rarely 2-4 times as many as the petals. Ovary inferior, 1-4-celled; ovules usually solitary, pendulous from the apex of the cells; style simple; stigma capitate or branched. Fruit usually succulent, stone 1-4-celled or less commonly with 2 pyrenes. **DISTRIB.** A small family scattered throughout the world but chiefly in the Northern Hemisphere.

Leaves opposite, entire	...	...	1. <i>Cornus.</i>
Leaves alternate, oblique, usually angular or lobed	...	...	2. <i>Marlea.</i>

1. *CORNUS*, Linn.

(The Latin name of one species, derived from *cornu*, horn; referring to the hard wood.)

Trees or shrubs. Leaves opposite (in the following species), entire, petiolate. Flowers small, white, green, yellow or purple, usually bisexual, in branched cymes or involucrate heads. Calyx-tube campanulate or urceolate, smooth, angular or ribbed, limb 4-toothed. Petals 4, oblong, valvate. Stamens 4,

anthers oblong, dorsifixed. Disk thick or inconspicuous. Ovary 2-(rarely 3-)celled. Fruit ovoid, drupaceous; stone bony; 2-celled, 2-seeded. DISTRIB. Species 30; chiefly in temperate regions.

Flowers in branched cymes.

Leaves 2-3 inches broad; fruit globose ...

Leaves 1-1.5 inches broad; fruit ovoid ... 1. *C. macrophylla*.

Flowers in globose heads surrounded by 4 large yellow petaloid bracts ... 2. *C. oblonga*.

... 3. *C. capitata*.

1. *CORNUS MACROPHYLLA*, Wall. in Roxb. Fl. Ind. ed. Carey I (1820) p. 433.—A medium-sized deciduous tree; bark rough, brown, splitting into small squares. Leaves 3-6 by 2-4 inches, ovate, acuminate, glabrous above, lower surface pale minutely adpressed hairy, base usually rounded; petioles .5-1.5 inches long. Flowers .4 inch diameter, pale yellowish-white, in terminal branched cymes about 3 inches across. Calyx .1 inch long, urceolate, densely silky. Petals .2 inch long, linear-oblong, minutely pubescent outside. Disk annular. Style swollen near the top. Fruit .2 inch diameter, globose, black, slightly pubescent. Vern. Kandar (Haz. Rp.).

Himalaya 4-8,000 feet. Common. Trans-Indus to Nepal. Usually in patches of moist deciduous forest. Wood pinkish-white, moderately hard, even-grained. It is used only for firewood. The hairs in this and the following species of *Cornus* are dorsifixed and the leaves papillose beneath. Flowers: April—June.

2. *CORNUS OBLONGA*, Wall. in Roxb. Fl. Ind. ed. Carey I (1820) p. 432.—A small tree, bark reddish-brown, rough. Leaves 4-5 by 1-1.5 inches, oblong, narrowed at both ends, minutely adpressed hairy on both sides, pale beneath and tumid in the axils of the nerves; petioles .2-.3 inch long. Flowers .3 inch across, pale yellowish-white, in terminal branched cymes about 2 inches across. Calyx .07 inch long, campanulate, slightly hairy. Petals .15 inch long, oblong, slightly hairy outside. Disk, anthers, and tip of the style purple. Fruit .3 inch long, ovoid, almost glabrous.

Himalaya 3,500-7,000 feet from the Rawalpindi District eastwards. Not common. Wood similar to that of *C. macrophylla*. Flowers: September—December.

3. *CORNUS CAPITATA*, Wall. in Roxb. Fl. Ind. ed. Carey I (1820) p. 434. A small tree, bark smooth, greyish-brown. Leaves 2-3.5 by 1-1.5 inches, oblong or elliptic, narrowed somewhat at both ends, rather densely adpressed pubescent on both sides, pale beneath; petioles .5 inch long, channelled, with broad bases. Flowers .15 inch across, closely packed in globose heads about .5 inch diameter, each head surrounded

by 4 yellowish petaloid bracts 1 inch or more long. Calyx campanulate, hairy. Petals .07 inch long, broad. Fruits coalescing into a succulent globose head 1-2 inches diameter, red when ripe, each drupe with a hard 1-seeded stone. Collett, Fl. Siml., fig. 67. Vern. *Tharmal*.

Himalaya 3,500-7,000 feet from the Beas eastwards. Common near Simla. The ripe fruit can be eaten and made into preserves. The tree is grown in gardens in South England and the Channel Islands where it is known as the *Strawberry tree*, the fruit being not unlike a strawberry. Flowers: May-July.

2. MARLEA, Roxb.

(From the vernacular name of the following species in Sylhet. *DISTRIB.* Species 10; Asia, Australia and Polynesia.)

MARLEA BEGONIÆFOLIA, Roxb. *Cor. Pl.* III (1819) p. 80, t. 288.—A small deciduous tree with smooth grey bark. Leaves alternate, 3-6 by 2.5-6 inches, variable, broadly ovate, acuminate, entire, angular or lobed, the lobes or angles acuminate, usually glabrous when mature, base usually truncate or cordate, often very oblique, 5-7-nerved; petioles 1-2 inches long. Flowers .6-.9 inch long, white, bisexual, in axillary cymes; bracts linear, hairy; pedicels jointed to the calyx. Calyx .1 inch long, campanulate, limb obscurely toothed. Petals 6-8, ligulate, valvate. Stamens 6-8; filaments short; anthers .8 inch long, linear. Ovary 2-celled; style slightly thickened upwards; stigma minutely 4-lobed. Fruit .3-.4 inch long, ovoid, glabrous, succulent, dark-purple, when ripe; stone usually 2-celled, 2-seeded.

Himalaya 3,500-8,000 feet from the Indus eastwards. Not common except in the Kagan valley, Hazara. Usually in moist ravines. Flowers: May-June.

XLVIII. CAPRIFOLIACEÆ.

Shrubs, erect or scandent or small trees, rarely herbs. Leaves opposite, rarely ternate, stipules usually wanting. Flowers bisexual, regular or zygomorphic. Calyx-tube adnate to the ovary; limb usually 5-toothed. Corolla gamopetalous, limb regular or 2-lipped, usually 5-lobed, lobes imbricate. Stamens usually 5, inserted on the corolla, alternating with its lobes. Ovary inferior, 1-5-(rarely more-)celled; ovules 1-many in each cell, pendulous from the inner angle or axile; style usually simple, elongate; stigma usually capitate. Fruit a drupe or a berry-like stone fruit, or capsular or dry. *DISTRIB.* A small family mostly northern and temperate.

Fruit 1-seeded; flowers regular.

Leaves usually toothed; calyx-limb
shortly toothed ...

... 1. *Viburnum*.

- Leaves usually entire; calyx-lobes elongate, feathery ... 2. *Abelia*.
 Fruit many-seeded; flowers often zygomorphic.
 Stems solid (except *L. quinquelocularis*); ovary 2-3-celled ... 3. *Lonicera*.
 Stems fistular; ovary 5-celled ... 4. *Leycesteria*.

1. **VIBURNUM**, Linn.(The Latin name of *V. Lantana*).

Shrubs or small trees. Leaves rarely ternate; stipules usually wanting (never conspicuous in the Indian species). Flowers regular, pentamerous, in terminal or subterminal, corymbose or paniced cymes (all fertile in Indian species). Calyx-tube turbinate or subcylindric; limb short, 5-toothed, persistent. Corolla campanulate, rotate or cylindric, lobes equal. Stamens inserted on the corolla-tube. Ovary 1-3-celled; ovules 1 in each cell; style short; stigma sub-3-lobed. Fruit a drupe, stone 1-seeded. **DISTRIB.** Species about 100; mainly in the North Temperate Zone.

Leaves entire or crenate.

- Leaves ovate or orbicular, tomentose beneath; calyx-limb 5-toothed ... 1. *V. cotinifolium*.
 Leaves oblong, glabrous; calyx-limb obsolete ... 3. *V. coriaceum*.

Leaves sharply toothed.

- Flowers after the leaves; corolla rotate ... 2. *V. stellulatum*.
 Flowers before or with the leaves; corolla tubular-funnel-shaped ... 4. *V. nervosum*.

1. **VIBURNUM COTINIFOLIUM**, *D. Don, Prodr. Fl. Nep.* (1825) p. 141.—A large deciduous shrub, twigs and inflorescence more or less stellately tomentose. Leaves 2-4 inches long, ovate or orbicular, base cordate or rounded, crenate or nearly entire, upper surface stellately pubescent or glabrous when mature, lower surface more or less densely grey stellately tomentose, rarely glabrous when old, usually thickish, nerves impressed above, prominent beneath; petiole .3-.8 inch long. Flowers .3 inch diameter, white, in corymbose cymes 2-4 inches across; bracts .3 inch long, linear, tomentose. Calyx .15 inch long, glabrous; limb 5-toothed. Corolla-tube .15 inch long, funnel-shaped, lobes .1 inch long. Drupe .3 inch long, oblong, red turning black when ripe. Stone dorsally 2-grooved, ventrally 3-grooved, compressed. *Collett, Fl. Siml. fig. 68.* Vern. *Taliana* (Ka).

Himalaya 4-11,000 feet. Trans-Indus to Bhutan. Common, especially in open sunny places. The fruit is edible. Flowers: April-June.

2. *VIBURNUM STELLULATUM*, Wall. *Pl. As. Rar.* II (1831) p. 54, t. 169.—A large deciduous shrub, twigs and inflorescence stellately pubescent. Leaves 3-6 inches long, ovate or ovate-lanceolate, long-acuminate, serrate; the teeth rather distant, acuminate; glabrous or slightly stellately pubescent beneath, membranous, lateral nerves conspicuous; petioles .3-1 inch long. Flowers .2 inch across, white, in corymbose cymes 3-5 inches across; bracts .2 inch long, linear, pubescent. Calyx, .05-.07 inch long, pubescent; limb 5-toothed. Corolla rotate, tube about .05 inch long; lobes slightly exceeding the tube, ciliate. Drupe .3 inch long, broadly oblong, red. Stone 2-grooved dorsally, slightly 3-grooved ventrally, much compressed.

Himalaya 6-8,000 feet from the Indus eastwards. Fairly common in moist shady places. Flowers: June—July.

3. *VIBURNUM CORIACEUM*, Blume, *Bijl.* (1825) p. 656.—A shrub or small tree, twigs pubescent near the bases of the petioles. Leaves 3-7 inches long, oblong, acuminate, entire, coriaceous, glabrous, inconspicuously punctate beneath; petioles .5-1 inch long. Flowers .1 inch across, white, in pedunculate umbellately branched cymes 3-5 inches across; bracts .15 inch long, linear, tomentose, very caducous. Calyx .05 inch long, glabrous, limb 0 or very obscure. Corolla .15 inch long, tubular, lobes very short, erect. Anthers purple. Drupe .2 inch long, ovoid, black. Stone 2-grooved dorsally, 3-grooved ventrally, compressed.

Outer Himalaya 3,500-8,000 feet from the Rawalpindi District eastwards. Not common. This plant is apt to be mistaken for *Cornus oblonga* but is readily distinguished by its glabrous leaves. Flowers: July—September or later at low elevations.

4. *VIBURNUM NERVOSUM*, D. Don, *Prodr. Fl. Nep.* (1825) p. 141.—A large deciduous shrub, foetid when bruised. Leaves 2-5 inches long, ovate, elliptic, oblong or obovate, acuminate-serrate, glabrous or more or less pubescent on the nerves beneath, thin, membranous, lateral nerves conspicuous, parallel; petioles .3-.6 inch long. Flowers .4-.5 inch across, white or tinged with pink, fragrant, appearing before or with the leaves, in compact or lax cymes 1-3 inches across; bracts variable in size, oblong or oblong-spathulate. Calyx .1 inch long, glabrous, teeth very small, irregular. Corolla-tube .3-.5 inch long; lobes elliptic, spreading. Stamens in 2 series, 2 near the mouth of the corolla-tube and 3 lower down. Drupe .3-.5 inch long; ellipsoid, red. Stone slightly grooved on one side, deeply grooved on the other, the endocarp deeply intruded into the seed. *V. foetens*, Dene. Brandis Ind. Trees, fig. 152. Vern. *Guch* (Haz, Rp.), *thalin* (Bash).

Himalaya 5-12,000 feet from the Indus eastwards. One of the commonest shrubs in the Himalaya. The flowers often appear soon after the leaves

have fallen in November and they continue to appear till May. The earlier flowers appear long before the leaves and they are smaller and in much denser cymes than the later flowers. The size of the flowers and laxness of the inflorescence is therefore of no value in distinguishing *V. fœtens*, *Decne.*, from *V. nerrosun*. The size of the fruit similarly varies somewhat. The leaves are usually glabrous, but I have found plants with the nerves of the leaves hairy growing mixed with plants with quite glabrous leaves and except for this character there was nothing to distinguish the two.

The following species familiar in gardens in Europe are cultivated in Abbottabad :—

VIBURNUM TINUS, *Linn.*—An evergreen shrub. Leaves 1·5-4 inches long, elliptic or ovate-oblong, entire, dark-green above, paler beneath and more or less hairy on the nerves and in their axils. Inflorescence 2-4 inches across. Flowers white, fragrant. *The Laurustinus*.

Indigenous to the Mediterranean region. Does well in Abbottabad.

VIBURNUM OPULUS, *Linn.*—*The Guelder Rose*.—A deciduous shrub. The form cultivated is var. *roseum*, *Linn.*, in which all the flowers are enlarged and sterile, forming a globular inflorescence. *The Snowball Tree* of English gardens. Indigenous to Europe and North Africa.

2. ABELIA, R. Br.

(In honor of Dr. Clarke Abel, physician to Lord Amherst's Embassy to China in 1817. **DISTRIB.** Species 11; 3 in Mexico, the rest Asiatic.)

ABELIA TRIFLORA, *R. Br. in Wall. Pl. As. Rar.* I (1830) p. 14, t. 15.—A large shrub, branches fluted, bark grey fibrous, twigs slender, clothed when young with downward directed hairs. Leaves 1·5-3 inches long, lanceolate or ovate-lanceolate, entire or on sterile shoots often with a few coarse teeth or lobes, narrowed upwards from below the middle, pilose when quite young, margins ciliate; petioles 1-2 inch long, their bases connate. Flowers 4 inch across, white or tinged with pink, in small bracteate 3-flowered cymes crowded in head-like clusters at the ends of the branches; the central flower sessile, pedicels of the 2 lateral 1 inch long; bracts and bracteoles foliaceous, the former often 1 inch long, the latter 15-25 inch long, linear. Calyx-tube 15 inch long, narrowly urceolate, 5-ribbed, pilose; teeth 5, linear, 3-5 inch long, feathery, persistent. Corolla-tube 4-5 inch long, tubular below, funnel-shaped at the top, pilose without; lobes 5, spreading. Stamens 4, inserted on the corolla-tube, included. Ovary 3-celled; ovules in 2 cells several, in the third cell solitary; style filiform; stigma capitate, scarcely exserted. Fruit coriaceous, dry, narrowly oblong, tipped with the calyx-teeth, 3-celled, 2 cells empty, the third 1-seeded. Brandis, *Ind. Trees*, fig. 150.

Himalaya 5-10,000 feet from the Indus eastwards. Common in the Kagan and Baspa Valleys. In the Outer Himalaya it is usually found on dry rocky ground. Flowers: May—July.

3. LONICERA, Linn.

(In honor of Adam Lonitzer, a German botanist of the 16th century.)

Erect or prostrate shrubs (or in some non-indigenous species twining). Leaves opposite entire, rarely lobed (in non-indigenous species often connate at the base), stipules usually wanting. Flowers in pairs on a common axillary peduncle or sessile in the leaf-axils (or in non-indigenous species sometimes in 3-flowered cymes arranged in terminal heads or panicles), pentamerous, regular or zygomorphic. Individual flowers subtended by a bract and two bracteoles, the latter distinct or connate or sometimes wanting. Calyx-tube ovoid; limb short, 5-toothed or almost truncate, deciduous or persistent. Corolla tubular or funnel-shaped, often gibbous at the base; limb 5-lobed, regular or nearly so, or 2-lipped, the upper lip erect, 4-toothed, the lower reflexed, entire. Stamens 5, inserted in the corolla-tube, usually near the mouth; anthers usually exserted. Ovary 2-3-celled; ovules 3-8 in each cell; style elongate; stigma capitate, usually exserted. Fruit a berry, berries distinct or united in pairs. **DISTRIB.** Species over 160; in temperate and sub-alpine regions of the Northern Hemisphere, rare in the tropics.

Bracts broad, bracteoles 0, or minute (see also *L. parvifolia*).

Bracts boat-shaped ... 1. *L. hispida*.

Bracts flat.

Twigs wiry; plant glabrous except the leaf margins ... 2. *L. glauca*.

Twigs stouter, not wiry; plant more or less hispid all over ... 3. *L. asperifolia*.

Bracts linear or narrow-oblong (sometimes broad in *L. parvifolia*), bracteoles often connate or prominent.

Corolla regular or nearly so.

Rigid more or less prostrate or dwarf shrubs; leaves usually not exceeding 5 inch long.

Stamens and style included ... 4. *L. parvifolia*.

Stamens and style more or less distinctly exserted.

Corolla-tube not gibbous at the base; leaves narrow-oblong ... 5. *L. spinosa*.

Corolla-tube gibbous at the base; leaves obovate ... 6. *L. obovata*.

Erect shrubs; leaves usually more than 5 inch long.

Flowers purple; berries black 7. *L. purpurascens*.

Flowers white or pink; berries red ... 8. *L. angustifolia*.

Corolla 2-lipped.

Twigs with pith; peduncle more or less conspicuous.

Leaves subsessile; peduncle .2-.4 inch long ... 9. *L. hypoleuca*.

Leaves petiolate; peduncle longer.

Peduncle .5-1 inch long; ovaries united ... 10. *L. orientalis*.

Peduncle 1-2 inches long; ovaries free ... 11. *L. alpigena*.

Twigs hollow; peduncle 0 or minute ... 12. *L. quinquelocularis*.

1. *LONICERA HISPIDA*, *Pall. ex Roem. & Schult. Syst.* 5 (1819) p. 258.—Erect, 4 feet high, twigs green, usually clothed with stiff hairs, the older light grey-brown with loose stringy bark. Leaves 1.3-3.5 by .6-1.8 inches, elliptic-ovate or lanceolate-oblong, dark green above, glabrous or with scattered hairs, lower surface paler, hairy on the nerves seldom on the whole surface; petioles up to .2 inch long, their bases connate. Flowers white or yellowish, nodding, on hairy peduncles .5-1.5 inches long. Bracts .7-1 inch long, ovate, boat-shaped, hispid, ciliate; bracteoles 0. Calyx-limb small or obsolete. Corolla .8-1.2 inches long, funnel-shaped, gibbous, hairy, lobes rounded, less than half the length of the tube. Stamens and style exserted. Berries .6 inch long, ovoid, surrounded by the whitish bracts.

Temperate and alpine Himalaya, 9-13,000 feet. Not common but occurs in Chamba and Marali, Simla. Flowers: June.

2. *LONICERA GLAUCA*, *Hook. f. & Thoms. in Journ. Linn. Soc. II* (1858) p. 166.—A dwarf, glaucous, densely branched shrub, glabrous except the leaf-margins, twigs wiry, often with a whitish bloom, the older with thin papery bark. Leaves .4-.8 by .15-.3 inch, oblong, obtuse, margins usually recurved, hispidly ciliate otherwise glabrous; petioles less than .1 inch long, their bases connate. Bracts .3 inch long, ovate, flat, ciliate, bracteoles 0. Peduncle hardly any. Calyx glabrous, limb toothed. Corolla .6-1 inch long, yellow, the tube slender, glabrous, gibbous at the base, slightly widened near the top; lobes rounded, much shorter than the tube. Stamens and style scarcely exserted. Berries confluent or not, .3 inch long, red, ovoid.

Inner dry Himalaya 12-16,000 feet. Grows in fissures of rocks. Not common. Sarul, Kagan; Spiti. Flowers: July.

3. *LONICERA ASPERIFOLIA*, *Hook. f. & Thoms. in Journ. Linn. Soc. II* (1858) p. 166.—Erect, 2-4 feet high, twigs hispid

with scattered bristly hairs, bark peeling off in thin fibrous strips. Leaves $\cdot 5\text{--}1\cdot 2$ by $\cdot 3\text{--}8$ inch, ovate or elliptic, base more or less cordate, dark-green, glabrous or nearly so above, paler and hispid beneath, margins bristly-ciliate; petioles up to $\cdot 2$ inch long. Bracts $\cdot 3$ inch long, ovate, flat, glandular pubescent and hispid; bracteoles 0. Peduncles $0\text{--}3$ inch long. Calyx-tube glabrous; limb truncate, ciliate or glabrous. Corolla $\cdot 6\text{--}8$ inch long, yellow; tube cylindric, slender, glabrous or nearly so, gibbous at the base; lobes elliptic, half the length of the tube. Stamens and style exserted. Berries $\cdot 5$ inch long, ovoid.

Inner dry Himalaya 10-13,000 feet. Not common but occurs in the Upper Kagan Valley and probably elsewhere. Flowers: May-July.

4. *LONICERA PARVIFOLIA*, Hook. f. & Thoms. in Journ. Linn. Soc. II (1858) p. 168.—A small rigid nearly glabrous shrub, twigs slender, bark fibrous. Leaves $\cdot 3\text{--}6$ by $\cdot 15\text{--}8$ inch, elliptic or oblong, dark green above, paler and reticulate beneath; petioles very short. Bracts foliaceous, $\cdot 15\text{--}3$ inch long, oblong or ovate; bracteoles connate, often nearly as long as the ovaries. Peduncles 0 to nearly as long as the leaves. Calyx-teeth conspicuous. Corolla $\cdot 25\text{--}3$ inch long, white tinged with pink; tube cylindric, not gibbous and scarcely widened upwards; lobes rounded, short. Stamens and style included. Berries $\cdot 25$ inch long, red, ovoid, not confluent.

Himalaya 8-12,000 feet. Common in rocky places. According to Rehder, Synopsis of the Genus *Lonicera*, in the Fourteenth Annual Report of the Missouri Botanical Garden p. 56, *L. parvifolia*, Edgew. = *L. obovata*, Royle. He calls the above plant *L. Myrtillus*, Hook. f. & Thoms. and distinguishes a variety var. *depressa* (sp. Royle). This variety which corresponds to the type as understood by Clarke in Fl. Brit. Ind., III, p. 13, has ovate bracts and long peduncles. It is commoner in the East Punjab than the form with narrow bracts and short peduncles. Flowers: May-July.

5. *LONICERA SPINOSA*, Jacq. ex Walp. Rep. Bot. II (1843) p. 449.—A dwarf rigid shrub, branchlets often leafless and spinescent, twigs very slender, bark fibrous. Leaves $\cdot 3\text{--}5$ by $\cdot 15$ inch or narrower, linear-oblong, dark-green above, pale beneath and reticulate, margins revolute; petioles very short, their bases broad sub-connate. Bracts $\cdot 15\text{--}2$ inch long, linear-oblong, foliaceous; bracteoles half as long as the ovaries, connate. Peduncles 0. Calyx-teeth conspicuous. Corolla $\cdot 4$ inch long, white tinged with pink; tube slender, not gibbous, slightly widened near the top; lobes elliptic, less than half the length of the tube. Stamens and style exserted. Berries $\cdot 2$ inch long, ellipsoid, not confluent (pale bluish-red to almost white, glaucous?)

Alpine Himalaya 11-16,000 feet. Not common in the Punjab but occurs in Kunawar and probably elsewhere. Flowers: June-July.

6. *LONICERA OBOVATA*, *Royle, Illustr. Bot. Himal.* (1889) p. 286.—A small suberect shrub, bark papery-fibrous. Leaves $\cdot 3\text{--}1$ by $\cdot 2\text{--}5$ inch, obovate or elliptic, base usually cuneate, green above, pale and reticulate beneath; petioles very short, their bases connate. Bracts $\cdot 25$ inch long, narrow-linear; bracteoles distinct or connate, half as long as the ovaries or wanting. Peduncles about $\cdot 2$ inch long. Calyx-limb very short, undulate. Corolla $\cdot 25\text{--}35$ inch long, yellow; tube widened upwards, gibbous at the base; lobes rounded, short. Stamens and style exserted. Berries $\cdot 3$ inch long, subglobose, bluish-black, confluent.

Himalaya 8-12,000 feet mainly on the inner ranges. Common in similar places to *L. parvifolia*, which superficially it much resembles. Flowers: May—July.

7. *LONICERA PURPURASCENS*, *Walp. Rep. Bot. II* (1843) p. 449.—Erect, 8 feet high, young twigs pubescent, bark papery-fibrous. Leaves $\cdot 7\text{--}2$ by $\cdot 5\text{--}1$ inch, elliptic, oblong, lanceolate or oblanceolate, hairy or glabrous above, more or less tomentose beneath; petioles $\cdot 2$ inch long. Bracts $\cdot 25$ inch long, linear or linear-lanceolate; bracteoles small, quadrate, glandular, ciliate. Peduncles $\cdot 3\text{--}1$ inch long, nodding. Calyx-limb truncate, glabrous. Corolla $\cdot 5$ inch long, dull purple, tubular-funnel-shaped, hairy within and without, gibbous at the base, lobes short. Stamens as long as the corolla. Style much exserted. Berries globose, black, confluent or not.

Himalaya 8-13,000 feet. Simla, Bashahr, also Kashmir and Trans-Indus. I have seen no specimens from Chamba or Hazara. Flowers: May—June.

8. *LONICERA ANGUSTIFOLIA*, *Wall. Cat.* (1828) No. 480.—Erect, 12 feet high, twigs slender glabrescent, bark papery. Leaves $1\text{--}2\cdot 5$ by $\cdot 3\text{--}8$ inch, lanceolate or sometimes ovate-lanceolate, pubescent when young, bright-green above, very pale beneath, narrowed at both ends; petioles $\cdot 15$ inch long. Bracts $\cdot 3\text{--}5$ inch long, linear or lanceolate; bracteoles connate, enclosing the ovaries. Peduncles $\cdot 3\text{--}1$ inch long, slender, puberulous. Calyx-limb 5-toothed; teeth $\cdot 05\text{--}07$ inch long, linear-lanceolate, ciliate. Corolla $\cdot 25$ inch long, white tinged with pink, tubular-ventriculose, not gibbous at the base, pubescent; lobes short, rounded. Stamens included. Style about as long as the corolla-tube. Berries globose, red, confluent.

Temperate Himalaya 6-12,000 feet from Kulu eastwards. Flowers: May—June.

9. *LONICERA HYPOLEUCA*, *Dcne. in Jacq. Voy. Bot. IV* (1843) p. 81, t. 89.—Erect, 6 feet high, twigs often purplish pubescent, bark fibrous. Leaves $\cdot 4\text{--}1$ by $\cdot 3\text{--}8$ inch, broadly ovate, obtuse, rounded or subcordate at the base, rather thick,

glandular and pubescent on both sides, very pale and glaucous beneath; petioles less than $\cdot 1$ inch long, joined by a raised line. Bracts $\cdot 1\text{--}\cdot 2$ inch long, lanceolate, foliaceous, bases connate; bracteoles connate, very hairy and glandular, nearly as long as the calyx. Peduncles $\cdot 15\text{--}\cdot 4$ inch long; hairy and glandular. Calyx-tube glandular-pubescent; limb toothed, persistent, teeth minute, deltoid. Corolla $\cdot 4\text{--}\cdot 6$ inch long, orange-yellow, hairy; tube gibbous at the base; limb 2-lipped, as long as the tube. Stamens and style equalling the upper lip of the corolla. Berries $\cdot 2$ inch long, ellipsoid, red, glandular-hairy, half enclosed by the glandular-hairy bracteoles.

Dry inner Himalaya 7-10,000 feet. Kunawar. Flowers: June—October.

10. *LONICERA ORIENTALIS*, Lamk. *Encyc. I* (1783) p. 781.—A large shrub 8-10 feet high, twigs glabrous, bark papery-fibrous. Leaves $1\cdot 5\text{--}4$ by $1\cdot 2\text{--}8$ inches, elliptic, ovate or ovate-lanceolate, apex pointed, scarcely acuminate, base cuneate or rounded, dark-green and glabrous above, paler beneath, glabrous or slightly hairy; petioles $\cdot 1\text{--}\cdot 3$ inch long. Bracts not longer than the ovaries, linear; bracteoles small or 0. Peduncles $\cdot 2\text{--}1$ inch long, glabrous. Calyx-teeth linear-lanceolate, glandular-ciliate. Corolla $\cdot 5$ inch long, pink, glabrous or nearly so, tube gibbous at the base, limb 2-lipped, much longer than the tube. Stamens and style rather shorter than the upper lip of the corolla. Berries $\cdot 25$ inch diameter, globose, black, usually confluent.

Var. DISCOLOR (sp. Lindl.).—Leaves glaucous beneath, often truncate or subcordate at the base. Peduncles up to $1\cdot 2$ inches long.

Temperate Himalaya 7-12,000 feet. Trans-Indus to Kumaon. Common. Flowers: May—July.

11. *LONICERA ALPIGENA*, Linn. *Sp. Pl.* (1753) p. 174.—A large shrub 8-10 feet high; twigs rather stout with large pith, sparsely hairy and glandular when young or glabrous; bark papery. Leaves $2\text{--}4$ by $1\text{--}2$ inches, elliptic to oblong-lanceolate, long pointed, usually narrowed at the base, sometimes slightly cordate, often nearly glabrous above, pilose-glandular and pale beneath; petioles $\cdot 2\text{--}\cdot 5$ inch long, joined by a raised line. Bracts $\cdot 2$ inch long, lanceolate or linear; bracteoles small or 0. Peduncles $1\text{--}2$ inches long, stout, slightly thickened upwards. Calyx-teeth short, glandular-ciliate. Corolla about $\cdot 5$ inch long, yellow fading to red, hairy and glandular; tube gibbous at the base; limb 2-lipped, much longer than the tube. Stamens and style equalling the upper lip of the corolla. Berries $\cdot 3$ inch long, ovoid, red, not confluent.

Temperate Himalaya 7-11,000 feet. Common in moist forest undergrowth. Flowers: May—July. Rehder l. c. considers the above plant distinct from *L.*

alpigena of Europe differing in the ovaries being free whereas they are connate in the European form. He calls the Indian plant *L. Webbiana*, Wall.

12. *LONICERA QUINQUELOCULARIS*, *Hardwick in As. Res. Soc. Beng.* VI (1799) p. 351.—A large shrub, rarely a small tree, twigs hollow, pubescent. Leaves 1·2·5 by ·7·1·5 inches, ovate or broadly lanceolate, obtuse or shortly acuminate, narrowed or rounded at the base, nearly glabrous above, more or less densely pubescent beneath; petioles ·2 inch long, joined by a raised line. Bracts linear, not exceeding the calyx; bracteoles about half the length of the calyx, hairy. Peduncles 0 or very short. Calyx hairy; teeth short, triangular. Corolla ·5 inch long, yellow, densely hairy; tube only slightly gibbous, often nearly as long as the 2-lipped limb. Stamens and style as long as the upper lip of the corolla. Berries ·25 inch long, ovoid, distinct, white, translucent. Collett, Fl. Siml., fig. 69. Vern. *Phut.* (Haz.)

Himalaya 4-12,000 feet, very common, usually in warm dry sunny places. Much the largest and the commonest of the indigenous species. It occasionally has a short bole 2 feet in girth. Flowers: April—June.

LONICERA JAPONICA, *Thunb.*—An evergreen twining shrub. Leaves 2·3 by 1·2 inches, ovate, hairy on the nerves, petiolate. Flowers 1·5·2 inches long, white tinged with red or purple, very fragrant, in axillary pairs; peduncles 2·5 inch long. Bracts ·5 inch long, ovate, foliaceous; bracteoles about half as long as the ovary, very hairy. Calyx-teeth distinct, ciliate. Corolla-tube slender, not gibbous, limb 2-lipped, about as long as the tube.

Indigenous to China and Japan. Commonly grown in gardens in the plains and in hill stations. The form grown is var. *chinensis* of Rehder's Synopsis. Flowers: April.

LONICERA CONFUSA, *DC.*—An evergreen twining shrub. Leaves 2·2·5 by ·8·1 inch, elliptic-lanceolate, thick, hairy especially beneath, petiolate. Flowers 1·5 inches long, yellow, usually in terminal panicles. Bracts linear, hairy, shorter than the calyx; bracteoles minute. Calyx-tube densely hairy as is also the toothed limb. Corolla hairy and glandular, limb 2-lipped, as long as the tube.

Indigenous to China. Cultivated in gardens. Abbottabad.

LONICERA SEMPERVIRENS, *Linn.*—Twining. Leaves 1·5·3 inches long, elliptic or oblong-lanceolate, the upper one or two pairs below the inflorescence connate into a suborbicular or oblong cup. Flowers in pedunculate whorls, the whorls often forming a short interrupted spike. Corolla orange and scarlet, 1 inch long, the tube 5·6 times as long as the erect subregular limb.

Indigenous to the Southern United States. Cultivated in gardens in the plains. Flowers: February—March.

4. *LEYCESTERIA*, Wall.

(In honor of W. Leycester, a friend of Dr. Wallich and at one time Chief Justice in Bengal. DISTRIB. Species 3; Himalaya, China.)

LEYCESTERIA FORMOSA, *Wall. in Roxb. Fl. Ind. ed. Carey*, II (1824) p. 181.—An erect undershrub 6 feet high, branches herbaceous, fistular. Leaves opposite, 2·5 by 1·3 inches, ovate

or ovate-lanceolate, long-acuminate, base truncate or rounded, entire or irregularly toothed, thin, membranous, pale beneath, hairy on the main nerves especially on the upper surface, otherwise glabrous; petioles .2-1 inch long, connate at the base. Flowers 1 inch long, white tinged with purple, in bracteate whorls of 5-6, combined in axillary drooping spikes. Bracts leaf-like, sessile, often with connate bases, ciliate, green tinged with purple; bracteoles similar, smaller. Calyx-tube ovoid, glandular-pubescent; limb 5-lobed; lobes unequal, persistent. Corolla funnel-shaped; limb subequally 5-lobed, Stamens 5, inserted in the throat of the corolla, equalling its lobes. Ovary 5-celled; ovules many, biseriate in each cell; style slender, exserted; stigma capitate. Berries .5 inch long, subglobose, dark-purple, glandular-hairy, tipped with the calyx-limb.

Himalaya 5-10,000 feet in moist forest undergrowth. Siran Valley Hazara; Patriata, Rawalpindi; Chamba; Bashahr and Simla eastwards to Assam. In the Punjab this plant appears usually to die back to the ground every winter but as cultivated in gardens in Europe it is decidedly shrubby. Flowers: June—July.

SAMBUCUS, *Linn.*—Herbs, shrubs or small trees. Leaves imparipinnate, leaflets serrate. Flowers small, in large flat-topped corymbose cymes. Calyx-limb 3-5-toothed. Corolla rotate or campanulate, 3-5-partite. Ovary 3-5-celled; ovules 1 in each cell; style 3-5-partite or stigmas 3-5 sessile. Fruit baccate, with 5-3 stones.

SAMBUCUS EBULUS, *Linn.*—A large erect herb. Leaves 6-12 inches long, foetid when bruised; stipules mostly foliaceous. Leaflets 5-9, 3-8 inches long, oblong-lanceolate, acuminate, sharply serrate. Flowers .2 inch diameter, white (yellowish-white or lemon-yellow?) in terminal corymbs 4-10 inches across. Fruit .2 inch diameter, red turning black when ripe. *S. Wightiana*, Wall. Kew Bull., 1909, p. 192. *The Dwarf Elder*, Vern. *Gandala*.

Dry inner valleys of the Himalaya 7-11,000 feet; Kagan Valley, Hazara; Pangl; Chamba. A common large gregarious herb, extending far into the arid portion of the Kagan Valley but in very dry places confined to banks of streams, &c.

SAMBUCUS NIGRA, *Linn.*—A deciduous shrub 6-10 feet high. Leaves 6 inches long, leaflets 5 (3-7) about 2.5 by 1.3 inches, elliptic, shortly acuminate, serrate. Flowers .2 inch diameter, white. Fruit black. *The Elder*.

Indigenous to Europe and Asia Minor. Cultivated in the plains and in hill stations. A form with variegated leaves is also frequently seen especially in Simla.

DIERVILLA FLORIDA, *Sieb. & Zucc.*—A deciduous shrub. Leaves 2-5 inches long, elliptic, narrowed at both ends, serrate. Flowers 1.5 inches long, rose-colored, in 1-3-flowered cymes. Corolla tubular-campanulate, limb about 1 inch across, subregular. Fruit an oblong capsule.

The Weigelia of English gardens. Indigenous to N. China. Does well in Abbottabad.

XLIX. RUBIACEÆ.

Trees, shrubs or herbs, erect, prostrate or scandent. Leaves opposite or whorled, entire, simple; stipules inter- or intrapetio- lar, rarely wanting. Flowers usually bisexual, regular, rarely zygomorphic, usually 4-5-merous. Calyx-tube adnate to the ovary; limb various. Corolla gamopetalous, funnel-shaped, salver-shaped or rotate, lobes valvate, imbricate or contorted to the left. Stamens as many as the corolla-lobes, inserted on the mouth or tube of the corolla, filaments short or long; anthers 2-celled. Disk epigynous, 2-lobed, annular or cup-shaped or wanting. Ovary inferior, 2-10-celled (usually 2-celled); ovules 1-many in each cell; style filiform or 2-many-branched. Fruit capsular or of dehiscent or indehiscent cocci, or baccate or drupaceous. **DISTRIB.** A large family mainly tropical and subtropical.

Flowers and fruits in globose heads.

- Petioles not exceeding 1 inch long (on flowering shoots); calyx truncate ... 1. *Mitragyna*.
 Petioles exceeding 1 inch long; calyx 5-lobed ... 2. *Adina*.

Flowers not in globose heads.

Fruit capsular.

Ovary 2-celled; trees.

- Capsules .5 inch long or more; flowers pedicellate ... 3. *Hymenodictyon*.
 Capsules .1 inch long; flowers sessile or subsessile ... 4. *Wendlandia*.

Ovary 5-celled; shrubs.

- Bracteoles free; capsule 5-valved at the top ... 5. *Hamiltonia*.
 Bracteoles united into a tube; capsule 5-valved to the base ... 6. *Leptodermis*.

Fruit indehiscent.

Fruit fleshy or succulent.

Corolla lobes twisted in bud.

- Flowers in long-peduncled trichotomous corymbose panicles ... 7. *Pavetta*.
 Flowers axillary, solitary or fascicled ... 8. *Randia*.
 Corolla-lobes valvate in bud ... 9. *Rubia*.
 Fruit dry, tipped by the much enlarged calyx-limb ... 10. *Gaillonia*.

1. **MITRAGYNA**, Korth. (*Stephegyne*, Korth.)

(From the Greek, *mitra*, a mitre and *gune*, a woman; referring to the shape of the stigma. **DISTRIB.** Species 8; Tropical Asia and Africa.)

MITRAGYNA PARVIFOLIA, Korth. *Obs. Naocl. Ind.* (1889) p. 19.—A large deciduous tree, trunk sometimes buttressed, bark grey, smooth, with shallow depressions left by exfoliating

scales. Leaves opposite, variable in size and shape, 2-5 by 1-5-8 inches, elliptic, orbicular or obovate, rounded acute or bluntly acuminate at the apex, base acute rounded or subcordate, glabrous above, minutely pubescent beneath, lateral nerves 6-8 pairs; petioles .4-1 inch long; stipules .5 inch long, oblong-spathulate. Flowers greenish-yellow, fragrant, in globose pedunculate heads .7-1 inch diameter, heads solitary, terminal or in cymes of 3, the terminal head sessile or shortly pedunculate, the lateral on peduncles 1-3 inches long each supported by a pair of foliaceous bracts. Bracteoles numerous minute, spathulate, hairy at the apex. Calyx-tube short, truncate. Corolla .2-.3 inch long; tube cylindric, narrow below, slightly widened near the top; lobes 5, short, valvate. Stamens 5, inserted near the top of the corolla-tube, anthers apiculate. Ovary 2-celled; ovules many, on pendulous placentas; style filiform; stigma conical, with a hollow base, cleft at the apex, much exserted. Capsules in globose heads of 100-150, each splitting into 2 dehiscent cocci. Seeds many, winged, minute. *Stephegyne parvifolia*, Korth. Fl. Brit. Ind., III, p. 25. Vern. *Kalam*.

Sub-Himalayan tract from the Ravi eastwards. Common in Kangra Wood light pinkish-brown, moderately hard, even-grained. Used for spoons, cups, combs and general agricultural purposes. The regeneration is poor and the tree not easily grown artificially. It is cultivated in Lahore. Flowers: June—July.

2. ADINA, Salisb.

(From the Greek, *adinos*, crowded; referring to the flowers being disposed in heads. DISTRIB. Species 9; Tropical Asia and Africa.)

ADINA CORDIFOLIA, *Benth. & Hook. f. Gen. Pl. II* (1873) p. 30.—A large deciduous tree, often buttressed, bark grey or brownish-grey, rough. Leaves opposite, 4-10 inches diameter, orbicular, shortly acuminate, base cordate, glabrescent above, pubescent beneath, lateral nerves 5-7 pairs; petioles 1-5-4 inches long, stout, pubescent; stipules .5-.7 inch long, oblong or obovate, obtuse. Flowers yellow, in globose pedunculate heads .7-1 inch diameter; peduncles axillary 1-4 together, 1-4 inches long, each bearing a solitary head (rarely more); bracts small, near the top of the peduncle. Bracteoles numerous, filiform, hairy. Calyx-tube 5-angled; lobes 5, deciduous. Corolla .25 inch long, densely pubescent; tube cylindric; slightly widened upwards; lobes 5, valvate. Stamens 5, inserted in the mouth of the corolla-tube. Ovary 2-celled; ovules many, on pendulous placentas; style filiform; stigma clavate, much exserted. Capsules in globose heads of 200-300, each splitting into 2 dehiscent cocci. Seeds many, oblong, minute, winged. Vern. *Haldu*.

Sub-Himalayan tract near the Jumna. A common tree in the United Provinces reaching a very large size. Wood yellow when fresh changing to

reddish-brown, even-grained, fairly hard. It is used for planking, combs, etc. The tree would be worth growing for ornament as a shade tree. I have never seen it cultivated though *Mitragyna parvifolia* is grown in Lahore and elsewhere under this name. Flowers : June—July.

3. HYMENODICTYON, Wall.

(From the Greek *humen*, skin or membrane, and *dictyon*, a net ; referring to the membranous, net-veined wing of the seeds. DISTRIB. Species 4-5 ; Tropical Asia and Africa.)

HYMENODICTYON EXCELSUM, Wall. in Roxb. Fl. Ind. ed. Carey, II (1824) p. 149.—A large deciduous tree ; bark brownish-grey, soft and corky in old stems. Leaves opposite, 4-10 by 3-5 inches, elliptic, ovate- or obovate-oblong, abruptly acuminate, membranous, pubescent on both surfaces, narrowed into the petiole, lateral nerves 7-10 pairs ; petiole 1-3 inches long ; stipules oblong, usually glandular-serrate, caducous. Flowers .2 inch long, white, fragrant, crowded on the spiciform branches of erect terminal panicles ; bracts like the leaves but smaller, long petioled, persistent after the leaves have fallen ; pedicels very short ; bracteoles minute. Calyx .1 inch long, narrowly campanulate, pubescent ; lobes 5-6, very short. Corolla .2 inch long, pubescent outside ; tube narrow cylindric ; limb cup-shaped ; lobes 5, short, valvate. Stamens 5, inserted below the throat of the corolla ; filaments short, dilated upwards. Ovary 2-celled ; ovules many ; style filiform, much exserted ; stigma clavate. Capsules .5-.7 inch long, ellipsoid, on stout decurved pedicels .2-.5 inch long, loculicidally dehiscent. Seeds .4 by .15 inch including the membranous reticulate wing which extends all round the seed and is deeply split at the base, Brandis, Ind. Trees, fig. 155.

Sub-Himalayan tract from the Ravi eastwards. Wood white when fresh, soft and light. Useful for planks, scabbards, etc. Flowers : June—August.

4. WENDLANDIA, Bartl.

(In honor of J. C. Wendland, a German botanica] author at the beginning of the 19th century.)

Shrubs or small trees. Leaves opposite or ternately whorled, stipules intra- or inter-petiolar, entire, or 2-fid. Flowers small, white, red or yellow, 4-5-merous, in terminal panicles. Calyx-tube subglobose ; lobes subequal, persistent. Corolla tubular, salver-shaped or funnel-shaped, throat hairy or glabrous, lobes imbricate. Stamens inserted between the corolla-lobes ; filaments 0 or elongate ; anthers exserted, versatile. Ovary usually 2-celled ; ovules many ; style slender ; stigma entire, 2-fid or 2-partite. Capsule small, usually loculicidally 2-valved. Seeds minute. DISTRIB. Species 16 ; Tropical and Sub-Tropical Asia.

- Stipules recurved; lateral nerves 12-20 pairs;
 capsules tomentose ... 1. *W. exserta*.
 Stipules erect; lateral nerves 10-12 pairs;
 capsules nearly glabrous ... 2. *W. puberula*.

1. *WENDLANDIA EXSERTA*, DC. *Prodr.* IV (1830) p. 411.—
 A small evergreen grey-tomentose tree, bark reddish-brown,
 rough, exfoliating in long strips. Leaves 4-9 by 1·5-8·5
 inches, lanceolate, ovate-lanceolate or narrow-oblong, acute,
 more or less pubescent above, grey-tomentose or pubescent
 beneath, lateral nerves 12-20 pairs; petioles ·5-1 inch long,
 downy; stipules interpetiolar, ovate, acute, downy, the
 upper part recurved. Flowers ·15 inch diameter, white,
 subsessile, fragrant, very numerous, in tomentose pyramidal
 panicles 6-10 inches long and broad. Calyx ·1 inch long,
 tomentose, lobes persistent. Corolla funnel-shaped; lobes as
 long as or longer than the tube. Filaments as long as the
 anthers. Style 2-fid. Capsules ·1 inch long, grey-tomentose.
 Vern. *Ukan* (Rp.) *Pánsara* (Ka.).

Sub-Himalayan tract and Outer Himalaya ascending to 4,000 feet from the
 Indus eastwards. Local in Hazara and Rawalpindi, very common in Kangra
 especially on landslips and steep slopes where the mineral soil is constantly
 exposed by erosion. Follows the main rivers far out into the plains and occurs
 on the Ravi bank at Shahdara. Wood reddish-brown, hard. It is said to be
 very durable and proof against white ants and is much appreciated by villagers
 in Kangra for poles, posts, &c. The stem is straight but short and of no
 great girth. The tree has been suggested for afforestation work but it appears
 to be difficult to grow from seed. I have tried it several times without
 success. The plant is ornamental when in flower and would be worth growing
 in gardens. Flowers: March—May.

2. *WENDLANDIA PUBERULA*, DC. *Prodr.* IV (1830) p. 412.—
 A small evergreen tree, bark rough, brownish-grey, young shoots
 and inflorescence hairy. Leaves 4-8 by 2·5-4 inches, elliptic-
 oblong, acute, pubescent on the nerves on both sides and puberu-
 lous on the lower surface, lateral nerves 10-12 pairs; petioles
 ·3-·7 inch long, stout, brown-pubescent; stipules with broad
 bases and erect caudate-acuminate tips, pubescent. Flowers
 ·2 inch diameter, bluish-white, sessile, in terminal and axillary
 panicles 3-6 inches long. Calyx ·07 inch long, hairy, lobes per-
 sistent. Corolla funnel-shaped; lobes shorter than the tube.
 Filaments as long as the anthers. Style 2-fid. Capsule ·1 inch
 long, nearly glabrous.

Sub-Himalayan tract and Outer Himalaya ascending to 4,000 feet. Rawal-
 pindi, Chamba and Kangra, not nearly as common as *W. exserta*. Flowers:
 May—June.

5. *HAMILTONIA*, Roxb.

(In honor of Mr. William Hamilton of Woodlands, Philadelphia, an
 eminent botanist and the first to erect a conservatory in that country for the
 preservation of the plants of a hot climate. DISTRIB. Species 3-4; India,
 Malaya and China.)

HAMILTONIA SUAVEOLENS, *Roxb. Hort. Beng.* (1814) p. 15.—An erect deciduous shrub 4-10 feet high, fœtid when bruised. Leaves opposite, 3-9 by 1·5-4 inches, elliptic-oblong or -ovate, acute, glabrous or pubescent, thin but tough, base narrowed into the petiole; lateral nerves 10-15 pairs, arcuate, joined by intramarginal nerves; petioles ·5-1 inch long; stipules short, abruptly cuspidate-acuminate, persistent. Flowers ·5 inch long, bluish-lilac, fragrant, collected in small bracteate head-like clusters arranged in lax trichotomous terminal panicles. Bracteoles small, subulate. Calyx-teeth 5, linear-subulate, hispid, persistent. Corolla-tube very slender below, widened somewhat in the upper half, pubescent; limb ·25 inch across, 5-lobed, lobes valvate. Stamens 5, inserted in the corolla throat, included or exserted, filaments short. Ovary 5-celled, the dissepiments more or less disappearing in fruit; ovules 1 in each cell; style filiform, with 5 linear branches, exserted or not. Capsules ·1-1·5 inch long, ovoid, 5-valved at the top. Seeds 5 or fewer by abortion, triquetrous, surrounded by a loose net-like outer coat formed from the inner wall of the ovary. Collett, Fl. Siml., fig. 71.

Sub-Himalayan tract and Himalaya ascending to 6,500 feet from the Indus eastwards. Salt Range. Common in dry hot places. According to Collett the flowers are sometimes white and Roxburgh figures them so in *Cor. Pl.*, tab. 236. I have always seen them blue. The North-West Indian specimens all have hairy calyx-teeth. Flowers: September—December.

6. *LEPTODERMIS*, Wall.

(From the Greek *leptos*, thin, delicate, and *derma*, skin; referring to the bark.)

Shrubs fœtid when bruised. Leaves opposite, the pairs often fascicled; stipules small, acute or pungent, persistent. Flowers white or purplish, crowded into head-like clusters, bracteate and bracteolate; bracteoles connate into a 2-cuspidate, scarious tube. Calyx-tube obconic; lobes 5, coriaceous, persistent. Corolla funnel-shaped, tube slender, hairy within; throat glabrous; lobes 5, valvate with inflexed edges. Stamens 5, inserted in the corolla-throat, filaments short; anthers linear-oblong, exserted or included. Ovary 5-celled; ovules 1 in each cell; style filiform, with 5 linear arms, exserted or included. Capsule 5-valved to the base. Seeds surrounded by a fibrous, simple or reticulate, loose or adpressed coat formed from the inner wall of the ovary. *DISTRIB.* Species 5; 1 Chinese, the rest Himalayan.

Leaves lanceolate or ovate ·5-4 by ·2-1·5 inches 1. *L. lanceolata*.

Leaves linear ·25-5 by ·1 inch ... 2. *L. virgata*.

1. *LEPTODERMIS LANCEOLATA*, Wall. in Roxb. *Fl. Ind. ed. Carey*, II (1824) p. 191.—A small deciduous shrub, bark thin, grey. Leaves very variable, .5-4 by .2-1.5 inches, lanceolate or ovate, pubescent on both surfaces especially on the nerves, with short white stiffish hairs, ciliate, lateral nerves 4-10 pairs, arcuate; petiole .1-.3 inch long; stipules broad, acuminate, hairy. Flowers .5-.7 inch long, white or tinged with purple. Bracteoles .1-.2 inch long, glabrous or hairy, exceeding the calyx. Calyx-teeth triangular, fringed. Corolla glabrous or pubescent, limb .3-.5 inch across. Capsule .3 inch long, cylindric, truncate, black, shining; seed with a loose fibrous covering.

Himalaya 4-10,000 feet from Kashmir eastwards. Fairly common in Bashahr in hedges, etc. Flowers: June—September.

2. *LEPTODERMIS VIRGATA*, Edgew. in Aitch. *Cat. Punjab Plants*, (1869) p. 70.—A slender, erect twiggy shrub 1-2 feet high. Leaves .25-.5 by .1 inch, linear, scabrid and dark-green above, glabrous beneath; petioles minute; stipules with pungent spreading tips. Flowers .3 inch long, pale purple. Bracteoles .15 inch long, glabrous, slightly exceeding the calyx. Calyx-teeth lanceolate, fringed. Corolla pubescent, limb .15 inch across. Capsule .2 inch long including the calyx-lobes, sub-cylindric, black, shining; seed with a few scarcely interlaced fibres.

Salt Range and Outer Himalaya 4-7000 feet from Murree westwards. Also in Kulu. Common in Hazara on dry stony soil. Has not been collected between Murree and Kulu. Flowers: July—September.

7. *PAVETTA*, Linn.

(From the vernacular name in Malabar. *DISTRIB.* Species about 60; tropics of the Old World and South Africa.)

PAVETTA INDICA, Linn. *Sp. Pl.* (1753) p. 110.—A large shrub, bark smooth, brownish-grey. Leaves 3-9 by 1-3.5 inches, elliptic, ovate-or obovate-oblong, acute or acuminate, pubescent above, softly tomentose beneath, lateral nerves 10-15 pairs, joined by intramarginal nerves; petioles .5-1.5 inches long, hairy; stipules caudate-acuminate, hairy, the bases persistent. Flowers .5 inch across, white, fragrant, in many-flowered trichotomous pedunculate cymose panicles; peduncles 4-7 inches long, in the axils of fallen leaves, sometimes bearing a few leaves at the base of the branches of the panicle; pedicels .2-.4 inch long, slender, pubescent. Calyx .1 inch long, pubescent, tube narrowly campanulate; teeth 4, minute. Corolla-tube .5 inch long, slender, limb .5 inch across; lobes 4, twisted, linear-oblong, spreading. Stamens 4, inserted in the throat of the corolla, filaments short; anthers long, slender, apiculate. Ovary 2-celled; ovules solitary in each cell; style filiform, exserted;

stigma small, subclavate. Fruit .3 inch diameter, globose, black, containing 2 concavo-convex pyrenes.

Sub-Himalayan tract from the Rawalpindi District eastwards. Common in hedges in Kangra. The above plant is var. *tomentosa* of the Fl. Brit. Ind., *sp. Roxb.* Flowers: April—June.

8. *RANDIA*, Linn.

(In honor of Isaac Rand, a British botanical author of the 18th century.)

Trees or shrubs, thorny or unarmed. Leaves opposite, one of the pair often arrested; stipules short, interpetiolar, free or connate. Flowers small or large, solitary or fascicled, white or yellowish. Calyx-tube ovoid or turbinate, ribbed or terete; limb cup-shaped or tubular, truncate, toothed or lobed, the lobes sometimes foliaceous. Corolla funnel-shaped, campanulate or salver-shaped; tube long or short, the throat glabrous or villous; lobes 5, twisted in bud. Stamens 5, anthers subsessile. Ovary 2-celled; ovules many; style short or slender; stigma clavate or fusiform, entire or 2-fid. Berry globose or ovoid, 2-celled, many-seeded, seeds often immersed in pulp. **DISTRIB.** Species about 100; throughout the tropics.

A small shrub; calyx-lobes narrow; berries .3 inch long ... 1. *R. tetrasperma*.

A large shrub; calyx-lobes broad; berries 1-1.5 inches long ... 2. *R. dumetorum*.

1. *RANDIA TETRASPERMA*, Benth. & Hook. f. in *Gen. Pl.* II (1873) p. 88.—A small deciduous shrub usually dwarf and rigid sometimes 2-3 feet high and then with much larger leaves, branches subspinescent. Leaves very variable, .2-2 by .15-.6 inch, from broadly obovate to lanceolate or oblanceolate, usually crowded on dwarf shoots, glabrous, base narrowed into a very short petiole; stipules acute or acuminate. Flowers .6-1 inch across, pale yellowish-green, fragrant, solitary, sessile or nearly so, terminal. Calyx-tube turbinate, lobes with deltoid bases and linear-subulate tips. Corolla-tube .3 inch long, cylindric below, widened in the upper half; lobes rather thick, as long as the tube, acute. Stigma fusiform. Berry .3 inch long, globose, purple, tipped with the persistent calyx-lobes.

Sub-Himalayan tract and outer hills ascending to 6,000 feet. Common on open slopes amongst rocks and sometimes in dry ravines. A very variable plant, the dwarf form is the commoner and it is often the result of the constant browsing of goats but is sometimes the effect of a dry shallow soil. The larger form is usually found in sheltered places but the plant is not found in very moist or very shady spots. Flowers: April—June.

2. *RANDIA DUMETORUM*, Lamk. *Tab. Encyc.* II (1793) p. 227.—A large deciduous shrub or small tree with grey bark; branches often armed with strong, straight, opposite, decussate,

axillary thorns .5-1.3 inches long. Leaves 1-3 by .6-2 inches, obovate, mostly fascicled on dwarf shoots, obtuse or acute, more or less pubescent on both surfaces especially on the nerves, base narrowed into a short marginate petiole; stipules deltoid-acuminate. Flowers .7-1 inch across, yellowish-green, fragrant, solitary or 2-3 together at the end of dwarf leafy branchlets; peduncles short. Calyx .5 inch long, strigose, tube campanulate; lobes ovate, foliaceous, as long as the tube. Corolla-tube .2 inch long, densely silky outside; lobes .5 inch long, thick, obovate-oblong, pubescent without, spreading, tips rounded. Stigma fusiform. Berry like a small apple, 1-1.5 inches long, globose or broadly ovoid, yellowish when ripe, tipped with the persistent calyx-lobes. Seeds flattened, embedded in gelatinous pulp. Brandis, Ind. Trees, fig. 159. Vern. *rāra*.

Sub-Himalayan tract from the Rawalpindi district eastwards. Common in open scrub forests in Kangra. Wood very hard and compact. The ripe fruit can be roasted and eaten. Flowers: April-June.

9. RUBIA, Linn.

(From the Latin *ruber*, red, referring to the dye, madder, yielded by *R. tinctorum*, Linn. DISTRIB. Species about 30; widely distributed.)

RUBIA INFUNDIBULARIS, Hemsley and Lace, in *Journ. Linn. Soc.* XXVIII (1891) p. 324.—A prostrate undershrub, shoots herbaceous, quadrangular, scabrid or glabrous, the older whitish or grey with thin papery bark. Leaves opposite or in whorls of 4, 1-2.5 by .1-.2 inch, linear, narrowed at both ends, somewhat scabrid on both surfaces, margins thickened recurved; petioles very short, joined by a raised line. Flowers .2 inch diameter, greenish-yellow, in axillary and terminal few-flowered cymes; pedicels up to .2 inch long, glabrous or pubescent. Calyx-tube minute, globose, glabrous or pubescent, limb 0. Corolla .1-.15 inch long, glabrous or pubescent, tube cylindric below widened in the upper half; lobes 4 or 5, lanceolate, acute, valvate. Stamens 4 or 5, inserted on the corolla-tube; anthers oblong, exserted. Ovary 2-celled; ovules solitary in each cell; styles 2; stigmas capitate, exserted. Fruit .2 inch diameter; globose, or didymous, fleshy, black. *R. albicaulis*, Boiss. var. *stenophylla*, Fl. Brit. Ind. III, p. 204.

Salt Range, Murree Hills and Kagan Valley, 4-8,000 feet. Usually found growing on rocks. Flowers: June-July.

10. GAILLONIA, A. Rich.

(Evidently named after a person of the name Gaillon, of whom nothing is known.)

Low rigid sometimes prickly desert shrubs. Leaves opposite, small, linear or subulate; stipules usually connate with the petioles into an entire sheath with 2 bristles or obsolete. Flowers

small, white, solitary or in simple spiciform cymes. Calyx limb almost wanting or 2-5-toothed, dilated after flowering into a scarious crenate wing or feathery bristles. Corolla funnel-shaped; throat naked; lobes 4-5, valvate. Stamens 4-5, inserted in the tube or throat of the corolla; filaments short; anthers linear-oblong. Disk inconspicuous. Ovary 2-celled; ovules solitary in each cell; style filiform, with 2 short linear branches. Fruit ovoid, of 2 terete indehiscent cocci, crowned with the enlarged calyx. DISTRIB. Species 12; from Nubia to Western India.

- Hoary and scabrid; calyx-limb in fruit
horizontal, orbicular, 5-lobed ... 1. *G. hymenostephana*
Glabrescent; calyx-limb in fruit erect,
oblong-lanceolate ... 2. *G. calycoptera*.

1. *GAILLONIA HYMENOSTEPHANA*, *Jaub. and Späth, Ill. Pl. Or. I* (1842) p. 146, t. 79.—Rigid, 6-12 inches high, foetid when fresh, branches slender, terete, hoary and scabrid. Leaves .25-.6 by .1 inch or less, linear-oblong, sessile, subobtusate, base narrowed, scabrid, margins ciliate, recurved; stipules of the lower leaves subobsolete, those of the upper small, membranous, connate. Flowers .15-.2 inch long, axillary or terminal, solitary or in 2-3-flowered fascicles. Calyx-tube .08 inch long, puberulous; limb membranous, reticulately veined, subpellucid, pale-yellow; lobes 5-7 rounded, small in flower, accrescent in fruit. Corolla puberulous. Fruit small, canescent, calyx-limb .3-.5 inch across.

Hazara 3,000 feet. Not common. Trans-Indus, Baluchistan.

2. *GAILLONIA CALYOPTERA*, *Jaub. and Späth, Ill. Pl. Or. I* (1842) p. 147, t. 80.—Erect, 12-18 inches high, branches terete, glabrescent. Leaves .5-1 inch long, linear, distant, margins revolute, the upper floral leaves connate with the stipules into an obconic membranous shortly 6-8-toothed sheath. Flowers .25 inch long, in spikes 1-1.5 inches long. Calyx-limb membranous, 2-fid. Corolla puberulous. Fruit puberulous, including the wings .3 inch long; cocci oblong, surmounted by the calyx-limb which is erect and scarious, the segments free or connate, oblong, lanceolate, white, veined, the wings thrice as long as the cocci.

Dry hills near Attock.

HAMELIA PATENS, *Jac.*—A large evergreen shrub. Leaves in whorls of 3-4, 2.5-6 by 1.5-2.5 inches, elliptic-oblong or oblong-obovate, shortly acuminate, base narrowed, puberulous on both sides especially on the nerves, lateral nerves 6-8 pairs, arcuate, prominent beneath; petioles .5-1 inch long; stipules subulate. Flowers nearly 1 inch long, scarlet, in terminal pedunculate panicles, consisting of a whorl of 3-4 branches and one central branch, each branch usually once forked with a solitary flower between two scorpioid

axes on which the second very shortly pedicellate flowers are borne. Calyx tube campulate, puberulus; teeth 5, minute. Corolla tubular, 5 angled, puberulous; lobes very short, erect. Stamens 5, inserted below the middle of the corolla tube; anthers linear, very long, reaching almost to the top of the corolla-tube. Ovary 5-celled.

Indigenous to Tropical America. Very commonly grown in gardens.

GARDENIA JASMINOIDES, *Ellis*.—An evergreen shrub. Leaves opposite, 1·5-2·5 inches long, elliptic or elliptic-oblong, coriaceous, glabrous, shining above, acute, scarcely acuminate, base narrowed; petioles very short; stipules combined into an intrapetiolar membranous sheath, deeply split down one side. Flowers solitary, terminal, white, 2-2·5 inches across, very fragrant, usually double. Calyx-tube ribbed or winged, the ribs or wings prolonged upwards as long linear segments.

Indigenous to China. Cultivated in gardens for its flowers both in the plains and at Abbottabad. More usually known as *G. florida*, *Linn*. Rather apt to be mistaken for *Tabernaemontana coronaria* from the double-flowered variety of which it may be distinguished by its stipules and the absence of latex.

GARDENIA LUCIDA, *Roxb.*—A small deciduous tree. Leaves 4-10 inches long, elliptic-oblong, narrowed into a short marginate petiole. Flowers large, white, solitary, appearing when the tree is leafless, fragrant. Calyx 7 inch long; teeth 4 inches long, lanceolate-subulate. Corolla tube 1·2-2 inches long; lobes obovate, 1·2 by ·7 inch.

Indigenous to Central India. Cultivated in Lahore. Flowers: April—May.

ANTHOCEPHALUS CADAMBA, *Miq.*—A large erect tree. Leaves opposite, 5-8 by 2·7-4 inches, elliptic-oblong, shortly acuminate, glabrous and shining above, more or less pubescent beneath, lateral nerves 8-12 pairs; petiole 7-1·2 inches long. Flowers orange, in solitary terminal globular heads 1-1·7 inches diameter. Corolla lobes imbricate. Fruit of many coriaceous pyrenes packed into a fleshy globose mass, 2-2·5 inches diameter, yellow when ripe, edible.

Indigenous to the Sub-Himalayan tract from Nepal to Assam and in south India. Cultivated in Lahore, Amritsar, &c.

RONDELETIA ODORATA, *Jacq.*—A small shrub. Leaves 1·5-2 inches long, elliptic, shortly petiolate. Flowers scarlet, orange in the throat, in compact terminal corymbose panicles.

A native of the West Indies and Mexico. Occasionally grown in gardens in the plains. Flowers: February—March.

CATESEEA SPINOSA, *Linn.*—A small shrub armed with straight axillary thorns. Leaves about 1 inch long or less, obovate. Flowers 4 inches long, 1·5-2 inches across, pale yellowish. Corolla pendulous, tubular below, narrowly funnel-shaped above.

Indigenous to the West Indies. Sometimes grown in gardens and conspicuous when in flower, the large flowers being quite out of proportion to the rest of the plant. Flowers: May—July.

COFFEA BENGALENSIS, *Roxb.*—A small deciduous shrub. Leaves variable in size, ovate or elliptic, membranous, glabrous. Flowers 1-1·5 inches across, white, fragrant, appearing before or with the leaves. Corolla-tube 5-7 inch long, limb spreading.

Indigenous east of the Jumna. Occasionally cultivated in the plains.

IXORA, *Linn.*—Shrubs or small trees usually evergreen. Flowers 4-merous, 2-bracteolate, in terminal compound trichotomous cymes. Corolla-tube long, very slender, lobes twisted in bud. Ovary 2-celled; style filiform, exserted. Drupe more or less didymous. A large genus very closely allied to *Pavetta*, but with the style less exserted and 2-branched:

IXORA PARVIFLORA, Vahl.—Leaves 3-5 inches long, oblong or elliptic-oblong, very coriaceous, obtuse. Flowers white. *The Torch Tree*. Cultivated in Lahore. Flowers: May.

IXORA UNDULATA, Roeb.—Leaves 4-7 inches long, usually oblong-lanceolate, membranous, acuminate. Flowers white. Also cultivated in Lahore. Flowers: May.

SERISSA FETIDA, Lamk.—A small shrub about 2 feet high. Leaves 5-7 inch long, elliptic-oblong. Flowers 5 inch long and as much across, solitary, axillary, sessile, white. Corolla tubular-funnel-shaped.

Indigenous to China and Japan. Has long been cultivated in gardens in India. The leaves and flowers are fetid when bruised.

L. COMPOSITÆ.

Herbs or shrubs, rarely trees. Leaves usually alternate; stipules 0. Flowers in heads, consisting usually of many similar or dissimilar flowers, sessile on the dilated top of the peduncle (*receptacle*) and surrounded by an involucre of bracts. Receptacle pitted or smooth, naked or furnished with bracteoles. Flowers 1-2-sexual. Calyx-tube adnate to the ovary; limb 0 or of scales, bristles or hairs (*pappus*). Corolla gamopetalous, epigynous, regular, ligulate or bilabiate. Disk epigynous. Stamens 4-5, inserted on the corolla alternating with its segments; anthers cohering into a tube which sheaths the style, the cells often tailed at the base. Ovary 1-celled; ovule solitary; style usually bifid; stigmas various. Fruit an achene, naked or crowned by the persistent sessile or stipitate pappus. **DISTRIB.** The largest family of flowering plants distributed throughout the world.

A.—Heads rayed (*i.e.*, corollas of the outer flowers ligulate, of the inner tubular).

Ray-flowers yellow.

Branches and leaves beneath cottony ... 7. *Pulicaria*.

Branches and leaves not cottony ... 6. *Inula*.

Ray-flowers lilac ... 2. *Microglossa*.

B.—Heads disciform (*i.e.*, corollas of all the flowers tubular or in *Pluchea* the outer filiform).

Flowers yellow.

Involucral bracts white, petaloid ... 4. *Anaphalis*.

Involucral bracts green, not petaloid.

Leaves 2-pinnatisect, aromatic ... 8. *Artemisia*.

Leaves simple, not aromatic.

Heads corymbose ... 6. *Inula*.

Heads solitary.

Leaves glabrous or nearly so ... 7. *Pulicaria*.

Leaves white-cottony beneath ... 5. *Phagnalon*.

Flowers purple.

Leaves not gland-punctate, corollas of the outer flowers filiform ... 3. *Pluchea*.

Leaves gland-punctate, corollas all tubular

... 1. *Vernonia*.

C. — Heads ligulate (i.e., corollas all ligulate) 9. *Lactuca*.

Note.—This key applies to the species described but not to all the indigenous members of the genera. In *Anaphalis* the petaloid bracts are apt to be taken for corollas and the heads appear to be radiate. I have included *Fluechea* in the division with purple flowers; in *P. lanceolata* they are purple but in the other species I have not seen fresh flowers nor can I ascertain the color.

1. *VERNONIA*, Schreb.

(In honor of W. Vernon, a botanist and traveller in N. America in the 17th century. *DISTRIB.* Species about 280; chiefly tropical and mostly American.)

VERNONIA CINERASCENS, *Schultz-Bip. in Schweinf. Fl. Æthiop.* (1867) p. 162.—Shrubby, 1-3 feet high, stems branched, terete, rather slender, grooved, ashy-pubescent. Leaves alternate, 7-2 by 2-6 inch, oblong-spathulate, apex rounded, apiculate, base narrowed, entire or with a few rather coarse blunt teeth, gland-punctate and pubescent on both sides. Heads .25 inch across, purple, homogamous, in many-headed terminal corymbose panicles. Involucre hemispheric; bracts linear-oblong, subacute or mucronate, pubescent, midribs well marked, purple. Corollas all tubular, glabrous, limb regular. Anther-bases obtuse. Style-arms subulate, hairy. Achenes .1 inch long, tapering to the base, 5-ribbed, clothed with rather stiff hairs. Pappus shorter than the corolla, about .2 inch long, white, hairs biseriate, the outer short and rigid, all persistent.

Plains of the Punjab; Salt Range. Flowers in the cold season.

2. *MICROGLOSSA*, DC.

(From the Greek *mikros*, small, and *glossa*, a tongue; referring to the small corollas of the ray flowers. *DISTRIB.* Species 9; Asia, Africa and Madagascar.)

MICROGLOSSA ALBESCENS, *Clarke, Comp. Ind.* (1876) p. 59.—An erect shrub 2-3 feet high, branches faintly grooved, pubescent. Leaves alternate, 2-3 inches long, lanceolate, acuminate, entire or serrate, glabrous above, pale and hoary beneath, narrowed into a short marginate petiole. Heads .3-.4 inch across, in many-headed terminal corymbs, heterogamous, rayed; ray-flowers female, fertile; disk-flowers bisexual, fertile. Involucre campanulate; bracts many-seriate, narrow, acute, the outer shorter. Receptacle flat, naked. Corollas of the ray-flowers ligulate, lilac, those of the disk-flowers tubular slightly dilated in the upper half, limb 5-fid. Anther-bases obtuse, entire. Style-arms flattened, tips long, lanceolate. Achenes puberulous, obscurely 5-angled. Pappus-hairs copious, dirty-white, not longer than the ripe achenes.

Himalaya 8-12,000 feet, on rocks. Kunawar, Chamba. Apparently not in the outer ranges and has not been collected in Kagan though it occurs in

Kishtwar and perhaps extends further west. Not uncommon in Kunawar. Flowers: July—September.

3. *PLUCHEA*, Cass.

(In honor of N. A. Pluche, who published the "Spectacle de la Nature" in Paris in 1732.)

Shrubs or undershrubs. Leaves alternate. Heads small, in terminal leafless corymbs or large and subsolitary, heterogamous, disciform, white, yellow, lilac or purple; outer flowers female, fertile, many-seriate; inner flowers bisexual, few, sterile. Involucre ovoid or broadly campanulate; bracts usually broad. Receptacle flat, naked. Corollas of the outer flowers filiform, shorter than their styles, 3-fid or minutely toothed at the apex, those of the bisexual flowers regular, tubular, with a slightly enlarged 5-fid limb. Anther-bases sagittate, the cells tailed. Style-arms of the bisexual flowers filiform, entire or 2-fid. Achenes small, 4-5-angled, more or less connate at the base. Pappus-hairs slender, 1-seriate, free or in sterile achenes very many, more or less connate at the base. **DISTRIB.** Species 30; Tropical and Sub-tropical.

Heads in compound corymbs.

Involucre ovoid, the outer bracts obtuse... 1. *P. lanceolata*.

Involucre campanulate, the outer bracts acute ... 2. *P. Wallichiana*.

Heads subsolitary ... 3. *P. arguta*.

1. *PLUCHEA LANCEOLATA*, C. B. Clarke, *Comp. Ind.* (1876) p. 94.—An erect shrub 2-3 feet high, stem and leaves grey with dense minute pubescence. Leaves 1-2·3 by ·2-·5 inch, oblanceolate or oblong, thick, coriaceous, obtuse, apiculate, base narrowed, margins entire or occasionally with a few coarse distant teeth, sessile. Heads ·3 inch across, purple, in many-headed compound corymbs. Involucre ovoid, contracted at the mouth; outer bracts broad, very obtuse, densely pubescent, tinged with purple; inner bracts linear, subacute, few. Pappus-hairs distinctly connate at the base. **Vern.** *Resham*.

Plains of the Punjab. Common. In flower or fruit almost throughout the year.

2. *PLUCHEA WALLICHIANA*, DC. *Prodr.* V (1836) p. 451.—A tall shrub, stems and branches terete, striate, the upper portions viscous-pubescent. Leaves 1-2·7 by ·4-1·1 inches, elliptic-oblong or obovate, obtuse or subacute, often apiculate, usually entire, sometimes faintly toothed, pubescent on both sides, sessile. Heads ·5-·7 inch across, in many-headed compound corymbs. Involucre campanulate; outer bracts short, ovate-oblong, acute, pubescent; inner bracts linear, acute,

pubescent at the apex. Achenes obscurely angled, the angles silvery-white, scarcely pilose.

Salt Range. Not common.

3. *PLUCHEA ARGUTA*, Boiss. *Diag. Sér. II, fasc. 3* (1856) p. 5.—A stout shrub, the upper parts glandular-pubescent. Leaves 1-2 inches long, variable in width, .2-.9 inch broad, obovate-oblong or oblanceolate, acutely serrate or lobulate, glandular-pubescent, base narrowed, sessile. Heads .3-.5 inch across, subsolitary. Involucre broadly campanulate; outer bracts very small, narrow-lanceolate, pubescent and ciliate, the intermediate similar but longer; inner bracts elongate, linear, acute, pubescent and ciliate at the tips. Achenes with a few adpressed hairs, slightly ribbed.

Salt Range. Kalabagh, on both sides of the Indus. Not common. Flowers: December—February.

PLUCHEA OVALIS, D.C. mentioned as occurring in the Salt Range in Fl. Brit. Ind. III, p. 272, has not been collected since Aitchison's time. The identification of the plant is doubtful,—*vide* Hooker l. c.

4. *ANAPHALIS*, DC.

(Said by De Candolle to be an ancient Greek name for some woolly plant, derived from *gnaphalon*, a lock of wool. DISTRIB. Species about 25; Asiatic, chiefly in temperate and mountainous regions.)

ANAPHALIS ROYLEANA, DC. *Prodr. VI* (1837) p. 272.—An erect undershrub about 12 inches high, lower half of the stem persistent woody, branches many, slender, densely grey-woolly. Leaves alternate, .5-1 by .15 inch or less, linear, green and slightly woolly above, densely grey-woolly beneath, margins recurved, sessile. Heads .25-.4 inch diameter, yellow, disciform, heterogamous, corymbose; outer flowers female, numerous, fertile; inner flowers bisexual, usually sterile. Involucre campanulate; bracts many-seriate, the inner .15 inch long, ovate, acute, petaloid, white, the outer shorter. Receptacle naked. Corollas of the outer flowers filiform, 2-4-toothed, those of the inner flowers tubular with a subcampanulate 5-fid limb. Anther-bases sagittate, tailed. Style 2-cleft, arms obtuse. Achenes very small, oblong. Pappus-hairs one-seriate, free, caducous.

Inner Himalaya 9-10,000 feet. Kunawar and Lahoul. Flowers: July. The heads are apt to be taken to be rayed with white rays and yellow disk as the inner involucre bracts are white and conspicuous. The above plant is var. 1 *Royleana* proper of the Fl. Brit. Ind. The other varieties appear to be less woody and often almost inseparable from *A. contorta*, Hook. f.

5. *PHAGNALON*, Cass.

(A name altered from the Greek *gnaphalon*, a lock of wool; referring to the plants being woolly. DISTRIB. Species 20; from the Canary Islands to the West Himalaya and Tibet.)

PHAGNALON NIVEUM, Edgew. in *Trans. Linn. Soc. XX* (1846) p. 68.—A small shrub or undershrub 4-10 inches high,

branches and leaves beneath snowy-white with dense cottony wool. Leaves alternate .5-1.5 by .1-.3 inch, from linear-ob-lanceolate to spatulate or elliptic-oblong, usually entire, more or less cottony or sometimes glabrous above, sessile. Heads .3-.5 inch across, solitary, yellow, heterogamous, disciform; flowers all fertile, the outer female, many-seriate, the inner bisexual. Involucre campanulate; bracts many-seriate, very narrow linear, dry with scarious margins, acute, more or less hoary or cottony, the outer smaller. Receptacle flat, slightly pitted. Corollas of the outer flowers filiform, minutely 2-3-toothed, those of the bisexual flowers slender, tubular, with a scarcely dilated 5-fid limb. Anther-bases sagittate, shortly tailed. Style-arms slender, obtuse. Achenes small, not ribbed, clothed with a few hairs. Pappus-hairs one-seriate, persist, much longer than the achenes.

Himalaya 4-9,000 feet, on rocks. From Garhwal westwards. Very common in Hazara. Flowers: May—June.

6. *INULA*, Linn.

(From the classical name of *I. Helenium*, Linn.)

Perennial herbs or shrubs. Leaves alternate, toothed. Heads large and solitary or small and corymbose, heterogamous, rayed, rarely disciform; ray-flowers female, fertile; disk-flowers bisexual, tubular. Involucre hemispheric or campanulate; bracts many-seriate, the outer often foliaceous. Receptacle flat or tumid, pitted or areolate. Corollas of the ray-flowers ligulate, ligules yellow or white, 3-toothed; corollas of the disk-flowers regular, yellow. Anther-bases sagittate. Style-arms linear, slightly flattened, broader upwards, obtuse. Achenes subterete, ribbed. Pappus-hairs few or many. **DISTRIB.** Species about 56; Europe, Asia and Africa.

Flower heads corymbose.

Heads disciform	... 1. <i>I. Cappa</i> .
Heads rayed	... 2. <i>I. cuspidata</i> .
Flowers heads solitary	... 3. <i>I. grantioides</i> .

1. *INULA CAPP*A, DC. *Prodr.* V (1836) p. 469.—An erect shrub 4-8 feet high, branches red, young shoots densely grey-silky. Leaves 3-6 by .7-1.5 inches, oblong-lanceolate, narrowed at both ends, thick, green and more or less densely adpressed hairy above, grey silky-tomentose beneath, teeth small cuspidate, often very distant and obscure; petiole almost 0.4 inch long, stout. Heads .3 inch across, yellow, corymbose, flowers all discoid or with few inconspicuous ligules. Involucral bracts

linear, rigid, acuminate, silky, the outer shorter. Achenes .07 inch long, silky; pappus .25 inch long, dirty-white.

Sub-Himalayan tract and Outer Himalaya ascending to 6,000 feet from the Indus eastwards. Common in forests of *Pinus longifolia* and on warm grassy banks. Flowers: September—October.

2. *INULA CUSPIDATA*, Clarke, *Comp. Ind.* (1876) p. 125.—A weak erect shrub 4-8 feet high, branches glabrous or nearly so. Leaves 3-5 by 1-2 inches, elliptic-lanceolate, acuminate, base narrowed, thin, membranous, pubescent when young, nearly glabrous when mature or rough above and thinly pubescent beneath, serrate, teeth gland-tipped; petiole .2-.5 inch long, slender. Heads .3 inch across, yellow, corymbose, radiate. Involucral-bracts linear, rigid, acute, outer shorter, pubescent. Achenes .07 inch long, silky; pappus .2 inch long, dirty-white. Collett, Fl. Siml., fig. 78.

Himalaya 3-7,000 feet, extending to Kagan, Chamba and Bashahr. Fairly common in moist ravines, &c. Flowers: September—November.

3. *INULA GRANTIODES*, Boiss. *Diag. Sér. II, fasc. 3.* (1856) p. 14.—A stout shrubby perennial 6-24 inches high, glandular-hairy; stem stout, woody. Leaves 1-2 inches long, variably lobed, the lower petiolate, cuneate, shortly 3-lobed, the upper sessile, linear, entire or 2-3-toothed at the apex, all fleshy, glandular and hairy. Heads .7-1.3 inches across, yellow, solitary, radiate, often furnished with 1 or 2 leafy bracts; peduncles stout, hairy. Involucral bracts linear-oblong, subacute, glandular and hairy, the outer smaller. Achenes .1-.15 inch long, strongly ribbed, hispid; pappus .3 inch long, rigid, scabrid.

Hills near Kalabagh. *DISTRIB.* Sind, Trans-Indus. Flowers: November—December.

7. *PULICARIA*, Gärtn.

(From *pulex*, a flea; *P. dysenterica* is the flea-bane of Europe.)

Annual or perennial, usually villous or woolly herbs, rarely shrubs. Leaves alternate, sessile, often amplexicaul. Heads solitary, rayed, heterogamous, or disciform and homogamous; ray-flowers female, 1-2-seriate; disk-flowers bisexual, fertile. Involucre hemispheric or obconic; bracts few-seriate, subequal or the outer shorter, linear. Receptacle flat or subconvex, pitted. Corollas yellow, those of the ray-flowers ligulate or tubular, those of the disk-flowers regular. Anther-bases sagittate, tails capillary, simple or branched. Style-arms linear, obtuse, slightly flattened, a little broader upwards. Achenes terete or ribbed. Pappus double, the outer a row of short jagged

teeth or a fimbriate cup, the inner of hairs. **DISTRIB.** Species about 24; Europe, Africa and Asia.

Branches and leaves beneath cottony;

heads rayed ... 1. *P. crispa*.

Branches and leaves glabrous or nearly

so; heads disciform ... 2. *P. glaucescens*.

1. *PULICARIA CRISPA*, *Benth. and Hook. f. in Gen. Pl.* II (1873) p. 336.—A stout undershrub 1-2 feet high, branches clothed with loose white cottony tomentum, woody below. Leaves 5-1.5 inches long, linear-oblong or linear-oblongate, undulate or irregularly coarsely crenate, clothed especially beneath with loose cottony tomentum, sessile, base semi-amplexicaul. Heads .3-.5 inch across, solitary, yellow, rayed. Involucral bracts pubescent, acute, the outer shorter. Achenes minute, glabrate. Pappus-hairs connate at the base in a ring, deciduous, white, about .1 inch long, thrice as long as the achenes.

Plains of the Punjab, common. Salt Range. Flowers: February—April.

2. *PULICARIA GLAUDESCENS*, *Jaub. and Spach, Ill. Pl. Orient.* IV (1853) t. 349.—A small shrub 6-15 inches high, branches ash-colored, glabrous or sparsely hairy. Leaves 1-2 inches long, linear or linear-spathulate, straight or slightly curved, margins entire, flat or involute, glabrous or nearly so, fleshy, sessile. Heads .8 inch across, solitary, yellow, disciform. Involucral bracts glabrous, lanceolate, acute, the outer shorter. Achenes minute, oblong, silky. Pappus-hairs shining, the outer not distinguished from the hairs on the achene, the inner much longer than the achene.

Plains of the West Punjab; Mari, Kalabagh. Salt Range. Flowers: January.

8. *ARTEMISIA*, Linn.

(From *Artemis*, the Greek name of Diana. **DISTRIB.** Species about 200; chiefly in the Northern Hemisphere.)

ARTEMISIA MARITIMA, *Linn. Sp. Pl.* (1753) p. 846.—A shrub with stout rootstock and lower branches, covered with fibrous bark; shoots slender, wiry, striate, hoary or somewhat white-woolly. Leaves .5-2 inches long, 2-pinnatisect, segments very many, small, spreading, linear, obtuse, more or less grey-hoary or tomentose, the upper leaves simple linear; petioles slender. Heads homogamous, disciform, 3-8-flowered, oblong or ovoid, a little more than .1 inch long, in spicate fascicles in the axil of a small linear or almost setaceous leaf; flowers yellowish, all fertile. Involucral bracts linear-oblong, with scarious margins, outer tomentose, inner glabrous. Receptacle minute,

naked. Corollas with a short cylindric tube and narrowly campanulate 5-fid limb. Anthers-bases obtuse, entire; connective apiculate. Style-arms with truncate penicillate tips. Achenes very minute. Pappus 0.

Inner arid valleys of the Himalaya 5-14,000 feet. Abundant in Kagan, Pangi and Kunwar. This plant is characteristic of the deep inner valleys of the Himalaya to which the monsoon does not penetrate. It covers the hill-sides replacing grass and herbaceous vegetation with its peculiar greyish foliage. In ascending a valley such as the Kagan Valley it is first found growing in dry rocky places at low levels and on southern aspects. Further up the valley it extends all over the southern slopes and of the lower vegetation becomes the dominant species. Grass may still predominate on the cooler northern aspects. Still further up the valley it extends to all slopes regardless of aspect, grass and other herbaceous vegetation being restricted to moist spots on the edges of streams. Towards the head of the Kagan Valley where the elevation is greater and the bottom of the valley is more exposed to moisture-bearing winds, grass reappears and soon replaces the *Artemisia*. In the deep valleys in which *Artemisia maritima* is the most conspicuous plant very little rain falls, precipitation being almost confined to snow in winter. For a deep-rooted plant the distribution of the rainfall is of little importance but a shallow-rooted plant, such as grass, requires frequent though not necessarily heavy precipitation and if long periods of drought occur they involve the dying down of the grass until the rainy season again comes round, as is seen in the zone of *Pinus longifolia*. In the deep inner valleys the precipitation occurs chiefly in winter when the temperature is too low for vegetative growth and is of no use to grasses and similar plants and consequently they are unable to compete with the *Artemisia*.

The foliage has a powerful aromatic smell but it is eaten by sheep and goats. The stout roots and branches are useful as fuel in the absence of other material. Flowers: August - September.

Many other members of this genus are also found, they are all herbaceous sometimes with a more or less woody root which in *Artemisia sacrorum*, Ledeb. is thick enough to be used as fuel. They all differ from *A. maritima* in having heterogamous flower heads.

9. LACTUCA, Linn.

(The Latin name of *L. sativa*, the lettuce, derived from *lac, lactis*, milk; referring to the milky juice. DISTRIB. Species about 90; mainly in north temperate regions of the Old World.)

LACTUCA ORIENTALIS, Boiss. *Fl. Orient.* III (1873) p. 819.— A much-branched rigid undershrub 6 inches to 1 foot or more high; branches slender, often spinescent, silvery-white, winged with the decurrent bases of the leaves the blades of which are often not or imperfectly developed, juice milky. Leaves 1-2 inches long, the lower pinnatifid with spreading or incurved triangular, acute, entire or toothed lobes, the upper often much smaller, linear or oblanceolate, entire. Heads .5 inch long, sessile, axillary and terminal, solitary or in fascicles of 2-5, homogamous, yellow. Involucre narrowly cylindric; bracts few, the outer ovate, the inner oblong, all with narrow membranous margins. Receptacle flat, naked. Flowers all ligulate. Anther-bases sagittate. Style-arms slender. Achenes .2 inch

long, pale, smooth, narrowed to both ends from the middle or a little above it. Pappus deciduous, silvery as long as the achenes.

Kunawar 9,000 feet. Has not been collected in Pangl or Hazara but as it is common Trans-Indus it may be expected to occur there. Flowers August.

TITHONIA DIVERSIFOLIA, Gray.—A large shrub 7-8 feet high. Leaves alternate, 4-10 inches long including the petiole, strongly 3-nerved, 3- or 5-lobed, softly pubescent on both sides, narrowed into a marginate petiole nearly as long as the blade. Flower heads solitary, axillary and terminal, 4 inches across, orange, radiate. Peduncle swollen near the flower. Disk-flowers enclosed in a stiff bract. Achenes quadrangular; pappus of 1-2 bristles and scales.

Indigenous to Mexico. Cultivated in gardens. Has become naturalized in the Sub-Himalayan tract near Dehra Dun and in Bengal. Grows readily from cuttings. Flowers in the cold season.

SAUSSUREA LAPPA, Clarke.—A tall stout herb, stems 6-7 feet high. Radical-leaves 2-3 feet long including the petiole which is lobately winged, the terminal lobe often 1 foot in diameter; cauline-leaves 6-12 inches long including the petiole, base auricled, semi-amplexicaul, all membranous, scabrous above, glabrate beneath. Heads homogamous, disciform, 1-1½ inches diameter, very hard, sessile, axillary or in terminal clusters of 2-5. Receptacle bristly. Involucral bracts many-seriate, numerous, ovate-lanceolate, acuminate, rigid, purple, pubescent when young afterwards glabrous and recurved at the tips. Corollas 7 inch long, dark purple, slender, tubular. Anther-bases sagittate, with fimbriate tails. Style-arms linear. Achenes glabrous, oblong, 4-ribbed, top contracted and cupped. Pappus double, hairs about 6 inch long, all feathery, connate at the base into a ring, deciduous.

Himalaya 8-12,000 feet. Kashmir, Kagan and Pangl. This plant is not common in British territory but is of considerable importance in Kashmir where the root (known in the vernacular as *Kut*) is collected and exported. About 2,000,000 lbs. are collected annually and the price obtained in Bombay is annas 4-8 per lb. The root yields a perfume resembling violets and is greatly in demand in China for ritualistic purposes, being burnt as incense in temples. Attempts have been made to cultivate it in Hazara but the plants were all dug up and the roots stolen.

MONTANOA HIBISCIFOLIA, C. Koch.—A large erect shrub 6-8 feet high. Leaves opposite, about 6 inches long and broad, deeply lobed, softly tomentose on both surfaces with grey shining hairs; petioles tomentose, winged near the top, the wing lobulate. Flower heads 1 inch across, white, in large terminal panicles, radiate. Heads spherical in fruit.

Indigenous to Central America. Recently introduced in gardens in N.-W. India and grows well but requires a moist cool situation in the plains. Grows readily from cuttings. Flowers in the cold season.

LI. ERIACEÆ.

Trees, shrubs or undershrubs. Leaves alternate, opposite or whorled; stipules 0. Flowers bisexual, regular or rarely slightly zygomorphic, bracteate and often 2-bracteolate. Calyx free or rarely adnate to the ovary, 4-5-fid or -partite. Corolla hypogynous, usually campanulate or urceolate, rarely polypetalous, lobes or petals usually 5, twisted or imbricate. Stamens usually 10, free or attached to the corolla, filaments free amongst themselves; anthers oblong, usually dehiscent by

apical pores or slits, the cells often produced upwards into tubes, sometimes spurred on the backs. Ovary usually 5-celled; ovules many in each cell, rarely few; style simple, filiform or columnar; stigma simple or shortly lobed. Fruit capsular, loculicidal or septidicidal, in *Gaultheria* apparently baccate as the capsule is enclosed in the enlarged succulent calyx. **DISTRIB.** A large family distributed throughout the world.

Flowers axillary, usually solitary. Small shrubs.

Leaves not imbricate and adpressed to the stem; calyx in fruit succulent ... 1. *Gaultheria*.

Leaves imbricate and adpressed to the stem; calyx in fruit unaltered ... 2. *Cassiope*.

Flowers in racemes; corolla ovoid. A tree ... 3. *Pieris*.

Flowers in corymbs; corolla funnel-shaped; or campanulate. Trees or shrubs ... 4. *Rhododendron*.

1. **GAULTHERIA**, Linn.

(In honor of Gauthier, a Canadian physician and botanist of the 18th century.)

Erect or procumbent shrubs. Leaves evergreen, serrulate, with glands on the lower surface at the base of long bristles. Flowers small, sometimes dimorphous, racemose or axillary and solitary; bracteate and 2-bracteolate. Calyx ovoid, 5-fid, in fruit enlarged, colored and succulent, enclosing the capsule. Corolla ovoid-tubular. Stamens 10; filaments attached to the base of the corolla, more or less dilated, pilose; cells more or less produced upwards, dorsally 1-2-horned; in some flowers the stamens are small with simple anthers. Ovary 5-celled; ovules many in each cell; style cylindric; stigma simple. Capsule 5-celled; loculicidally 5-valved from the apex. **DISTRIB.** Species nearly 100; mostly American.

Leaves broadly ovate, lower surface setulose ... 1. *G. nummularioides*.

Leaves narrow-oblong, lower surface glabrous ... 2. *G. trichophylla*.

1. **GAULTHERIA NUMMULARIOIDES**, D. Don, *Prodr. Fl. Nep.* (1825) p. 150.—Prostrate, stems densely hirsute. Leaves alternate, .5-.8 by .4-.6 inch, broadly ovate, sometimes sub-orbicular, acute, base rounded or cordate, glabrous above, setulose beneath and on the margin; petiole minute. Flowers .25 inch long, pink or white, solitary, axillary; pedicels .1 inch long, densely clothed with coriaceous glabrous ovate-oblong bracts .15 inch long. Calyx-teeth .12 inch long, lanceolate. Corolla tubular, lobes minute, recurved. Anther-cells shortly produced, 2-horned at the apex. Succulent calyx .3 inch diameter, dark-blue.

Himalaya 8-12,000 feet from the Sutlej eastwards. Chor, Marali, covering banks. Has not recently been collected in Bashahr, though *Royle, Illust. Bot. Himal.* p. 260, gives Kunawar as one of his localities. Flowers: July—September.

2. *GAULTHERIA TRICHOPHYLLA*, Royle, *Illustr. Bot. Himal.* (1839) p. 260, t. 63, fig. 3.—Stems erect, wiry, 2-6 inches high, more or less hirsute. Leaves alternate, about .25 by .1 inch, oblong, sub-acute or rounded, base cuneate or rounded, glabrous on both sides, glossy above, margins bristly, obscurely serrulate; petiole very minute. Flowers .2 inch long, pink or nearly white, solitary, axillary; pedicels .1 inch long, densely clothed with ovate bracts .1 inch long. Calyx-teeth .1 inch long, ovate-oblong. Corolla widely campanulate. Anther-cells not produced upwards, with a spreading spur below the pore. Succulent calyx .3 inch diameter, dark-blue.

Himalaya 9-13,000 feet. On moist rocks. Kagan and Siran Valleys, Hazara; Chamba; Bashahr. Not on the outer hills. Flowers: June—August.

2. CASSIOPE, D. Don.

(Named after *Cassiope*, of Greek mythology; the mother of *Andromeda*, also the name of a genus of this family. **DISTRIB.** Species 7; Arctic regions and high Asiatic mountains.)

CASSIOPE FASTIGIATA, D. Don, in *Edinb. Phil. Journ.* XVII (1834) p. 158.—A small fastigiate shrub, forming dense tufts 6-12 inches high. Leaves .2 inch long, somewhat 4-fariously imbricate, ovate-oblong, adpressed, thick but with a narrow hyaline margin which is prolonged into a cuspidate point, the thickened back with a narrow longitudinal groove which opens into a cavity in the leaf. Flowers .3 inch long, white, solitary or 2-4 together; pedicels 0-.3 inch long, woolly. Sepals 5, free, imbricate, about .15 inch long, oblong, thick, acute, margins scarious, often toothed. Corolla widely campanulate, lobes 5, short, recurved. Stamens 10, slightly attached to the base of the corolla; filaments linear; anthers ovoid, truncate, each cell with a horn from beneath the summit. Ovary 5-celled; ovules many in each cell; style cylindric; stigma simple. Capsule as long as the persistent calyx segments, globose, apex depressed, loculicidally 5-valved. Seeds minute.

Himalaya 10-13,000 feet. On moist rocks more or less gregarious in patches. Kagan; Chamba; Huttoo, Chansil, Simla; Kunawar. Flowers: June—July.

The anatomical structure of the leaf is very remarkable. The leaves are adpressed to the stem and the upper surface, that is the surface next to the stem has an epidermis in which there are no stomata. The pallisade tissue is found on the lower surface of the leaf from the edge of the thickened portion to the median groove. The cavity is lined by an epidermis with glandular hairs and stomata, beneath which there is a spongy tissue. The stomata are thus efficiently protected against rapid transpiration.

3. PIERIS, D. Don.

(*Pieris* was a name applied to the Muses from their supposed abode at Pieria, in Thessaly. **DISTRIB.** Species 12; Himalaya, Burma, Japan and N. E. America.)

PIERIS OVALIFOLIA, D. Don, in *Edinb. Phil. Journ.* XVII (1834) p. 159.—A small deciduous tree with reddish-brown fibrous, longitudinally fissured bark. Leaves alternate, 2·5-6 by 1·3 inches, ovate or elliptic, acute or acuminate, entire, base rounded, coriaceous, glabrous or pilose beneath; petiole ·2-·5 inch long. Flowers ·3-·4 inch long, white, in simple terminal and axillary racemes, occasionally a few flowers solitary in the leaf axils; racemes 1·4 inches long; pedicels ·1-·3 inch long; bracts ·1-·2 inch long, linear, caducous. Calyx-segments 5, connate at the base, ·1 inch long, triangular-lanceolate. Corolla ovoid, slightly pubescent without, lobes 5, short, recurved. Stamens 10, filaments with two horns divaricate from the apex; anther-cells ovoid, truncate. Ovary globose, 5-celled; ovules very many in each cell; style cylindric; stigma capitate. Capsule ·2 inch diameter, globose, supported by the persistent calyx, loculicidally 5-valved. Seeds many, minute, linear-oblong. Collett, Fl. Siml., fig. 89. Vern. *Erau* (Ku, and Bash.), *ailan* (Ka.), *ratankāth* (Haz.), *yarta* (Bash.).

Himalaya 3-8,000 feet from the Indus eastwards; common east of the Ravi. The wood is light reddish-brown, fairly hard but warps and shrinks badly in drying. It is not used. As firewood it is almost valueless as it is difficult to light and only smolders. The leaves are poisonous to goats and are not eaten by cattle. They can be used as an insecticide. The tree is usually associated with *Quercus incana* and *Rhododendron arboreum*. Leafless for a short time in the cold weather. Flowers: April—June.

4. RHODODENDRON, Linn.

(From the Greek, *rhodon*, a rose, and *dendron*, a tree.)

Trees or shrubs; often scaly or aromatic. Leaves alternate, often clustered towards the ends of the branches, entire, coriaceous. Flowers fascicled or subcorymbose, terminal, rarely solitary or axillary; bracts broad, generally caducous; bracteoles linear. Calyx 5-lobed, persistent, sometimes small or obsolete, rarely saucer-shaped. Corolla campanulate, widely funnel-shaped or cylindric, tube long or short, limb 5-lobed, somewhat zygomorphic. Stamens 5-10; anthers oblong, dehiscing by terminal pores. Ovary usually 5-celled; ovules very many in each cell; style long or short; stigma capitate. Capsule short and woody or elongate and thinner, septicidal, valves breaking away from the placentas. Seeds margined, winged or tailed. **DISTRIB.** Species about 230; mainly in the Mountains of Asia.

Flowers in terminal corymbs.

A tree. Leaves silvery beneath. Flowers usually scarlet-crimson ... 1. *R. arboreum*.

A shrub. Leaves with a cinnamon-colored tomentum beneath. Flowers pale pink or lilac ... 2. *R. campanulatum*.

A small shrub. Leaves with ferruginous scales beneath. Flowers yellow ... 3. *R. Anthopogon*.

Flowers usually solitary, deep purple. A small shrub. Leaves dotted beneath with scales ... 4. *R. lepidotum*.

1. RHODODENDRON ARBOREUM, *Smith, Exot. Bot.* (1804) t. 6.—An evergreen tree, bark reddish-brown, peeling off in small flakes. Leaves 3-6 by 1·2-2·2 inches, crowded towards the ends of the branches, lanceolate or oblong, narrowed at both ends, glabrous above with impressed midrib, silvery beneath from a film of small scales, the nerves and midrib prominent; petioles stout, ·5-1 inch long. Flowers 1-2 inches long, scarlet-crimson, crowded in large rounded corymbs; pedicels 0·3 inch long; bracts densely silky except near the margin, ciliate. Calyx-teeth unequal, usually nearly ·1 inch long, broadly ovate. Corolla campanulate. Stamens 10, alternately longer. Ovary mealy or rusty-woolly, usually 7-9-celled. Capsule 1 by ·3 inch, cylindric, curved, mealy, longitudinally ribbed. Vern. *Brás, Chahán* (Haz.).

Himalaya 4-8,000 feet, from the Indus eastwards. Rare in Hazara (Siran valley; Changle-gali), common east of the Ravi. Almost always associated with *Pieris ovalifolia* and *Quercus incana*. Reaches 30-40 feet with a girth of 7-8 feet or more. Wood reddish-white or reddish-brown, close and even-grained but warps and shrinks in drying. It is a bad firewood, scarcely better than *Pieris ovalifolia* in this respect. The flowers are occasionally pink or spotted and very rarely white. Flowers March-May, occasionally again in July—August if the spring flowering has been checked by hail or drought.

2. RHODODENDRON CAMPANULATUM, *D. Don, in Mem. Wern. Soc.* III (1821) p. 410.—An evergreen gregarious shrub, bark smooth, thin, grey. Leaves 3-5 by 1·7-2·5 inches, crowded towards the ends of the branches, elliptic or elliptic-oblong, rounded at both ends, mucronate, glabrous above, clothed beneath with a dense cinnamon-colored tomentum which obscures the nerves, midrib not impressed above, prominent beneath; petioles stout, ·4-·8 inch long. Flowers 1-1·5 inches long, lilac, pale-purple or whitish-pink, in lax corymbs; pedicels ·7-1 inch long; bracts silky. Calyx-teeth very small, broad-triangular. Corolla campanulate. Stamens 10; filaments glabrous. Ovary 5-9-celled, glabrous or nearly so. Capsule ·7-1·2 by ·25-·3 inch, cylindric, more or less curved, longitudinally furrowed. Vern. *Simrang* (Kun.)

Himalaya 9,500-14,000 feet from the Ravi eastwards, also in Kashmir. Usually in gregarious patches with the branches bent down by snow. Occurs both on the outer and inner ranges. Flowers: May—July.

3. RHODODENDRON ANTHOPOGON, *D. Don, in Mem. Wern. Soc.* III (1821) p. 409.—A small evergreen aromatic shrub,

twigs rough and scaly. Leaves $\cdot 5\text{--}1\cdot 2$ by $\cdot 3\text{--}\cdot 8$ inch, crowded towards the ends of the branches, elliptic or elliptic-oblong, thick, margins recurved, glabrous above, clothed beneath with a dense layer of ferruginous scales, subobtusate at both ends; petiole $\cdot 1\text{--}\cdot 3$ inch long. Flowers about $\cdot 6$ inch across, yellow, in dense 4-12-flowered corymbs; pedicels very short; bracts scaly, margins woolly. Calyx-teeth elliptic, obtuse, margins woolly. Corolla-tube $\cdot 2\text{--}\cdot 3$ inch long, cylindric; throat hairy; lobes spreading, elliptic-obovate. Stamens 6-8, included. Ovary 4-5-celled, scaly. Capsule $\cdot 2$ inch long, ovoid, scaly.

Alpine Himalaya 9,500-16,000 feet. Gregarious. Kagan; Chamba; Bashahr; Marali and Chur Mts. Flowers: June-July.

4. *RHODODENDRON LEPIDOTUM*, Wall. *Cat.* (1828) No. 758.—A small evergreen aromatic shrub, twigs rough from the prominent leaf-scars. Leaves $\cdot 6\text{--}1$ by $\cdot 25\text{--}\cdot 4$ inch, crowded towards the ends of the branches, oblanceolate or oblong-oblanceolate, acute or rounded at the apex, more or less densely dotted on both sides with rounded scales, subsessile. Flowers 1 inch across, purple, solitary or 2-3 together; pedicels $\cdot 5\text{--}1$ inch long, scaly; bracts ovate, leaf-like, scaly. Calyx-teeth oval, obtuse. Corolla-tube $\cdot 2$ inch long, as broad as or broader than long; lobes spreading, rounded. Stamens 8-10, exserted; filaments very hairy below. Ovary 5-celled, scaly. Capsule $\cdot 2\text{--}\cdot 3$ inch long, ovoid-oblong, scaly.

Alpine Himalaya 8,000-16,000 feet. Kagan and Siran Valleys, Hazara; Chamba; Bashahr; Jako, Huttoo and Chansil. Flowers: June-July.

ARBUTUS UNEDO, Linn.—A small evergreen tree. Leaves alternate, 2-2 $\frac{1}{2}$ inches long, coriaceous, narrowly elliptic-oblong, serrate. Fruit a tuberculate berry about $\cdot 8$ inch diameter, bright red. *The Strawberry Tree* of English Gardens. Indigenous to S. Europe, N. Africa and Asia Minor. Cultivated in Abbottabad.

LII. PLUMBAGINACEÆ.

Herbs, undershrubs or sometimes shrubs. Leaves radical, rosulate or cauline and alternate; stipules 0. Flowers bisexual, regular, pentamerous, bracteate; bracts usually rigid, dry and scarious. Calyx inferior, gamosépalous, tubular or funnel-shaped, folded between the lobes, usually scarious, persistent. Corolla hypogynous, gamopetalous, salver-shaped or the petals almost free, imbricate. Stamens as many as and opposite the corolla-lobes or petals, adnate to the base of the corolla. Ovary free, 1-celled; ovule 1, anatropous, suspended from a long basal funicle; styles 5, free or more or less connate. Fruit usually included within the calyx, dry, dehiscent or indehiscent. **DISTRIB.** A small family mainly maritime or in saline or rocky deserts,

Leaves rosulate, rigid, pungent ... 1. *Acantholimon*.

Leaves cauline, not rigid or pungent ... 2. *Plumbago*.

1. ACANTHOLIMON, Boiss.

(From the Greek *akantha*, a spine, and *limon*, the Sea Lavender, *Statice* sp. DISTRIB. Species 80; Greece to Kashmir, most numerous in Persia.)

ACANTHOLIMON LYCOPODIODES, Boiss. in DC. Prodr. XII (1848) p. 632.—A dwarf shrub forming dense rounded cushion-like masses 1-2 feet across. Leaves rosulate, .5-1 by .1 inch or less, linear, rigid, with sharp needle-like points, entire, sessile. Flowers .3 inch across, rose-pink, in terminal pedunculate capitate spikes; peduncles .5-2 inches long, minutely pubescent; bracts .2 inch long, ovate, cuspidate, margins scarious. Calyx .2-.3 inch long, tubular in the lower half, pilose outside, strongly ribbed; limb funnel-shaped, white, folded between the stiff ribs, subtruncate. Petals 5, shortly united at the base into a tube with the stamens. Stamens 5; filaments linear; anthers oblong. Ovary 5-angled; styles distinct at the angles of the ovary; stigmas capitate. Fruit an utricle, included within the calyx, membranous.

Inner dry Himalaya 10,000-14,000 feet. Common in the Upper Kagan Valley at Burawai and Besal, on rocks. Flowers: July–August.

2. PLUMBAGO, Linn.

(From the old Latin name used by Pliny, derived from *plumbum*, lead; the plant is said by him to be efficacious in curing lead-poisoning. DISTRIB. Species 10; warmer regions of the world.)

PLUMBAGO ZEYLANICA, Linn. Sp. Pl. (1753) p. 151.—A shrub with long rambling herbaceous branches, branches striate, twigs glandular. Leaves cauline, 1.5-3 by .8-1.8 inches, ovate, subacute, entire, glabrous, thin, glaucous beneath, base abruptly narrowed into the petiole which is .5-1 inch long, margined in the upper half, amplexicaul at the base and there often dilated into stipule-like auricles. Flowers .6 inch across, white, in lax spikes 2-6 inches long; bracts .15-.3 inch long, ovate, acuminate, glandular or not. Calyx .4-.5 inch long, cylindric, densely clothed with gland-tipped hairs; teeth 5, short, margins membranous. Corolla-tube slender, twice as long as the calyx; lobes 5, spreading, obovate-oblong, acute, apiculate. Stamens 5; filaments free from the corolla, dilated at the base; anthers linear-oblong, purple, scarcely exerted. Ovary attenuated into a filiform style which divides into 5 longitudinally stigmatose branches. Fruit a capsule, circumsciss near the base and splitting upwards into 5-valves, oblong, pointed, as long as the persistent calyx.

Sub-Himalayan tract ascending to 5,000 feet from the Indus eastwards. Fairly common. Salt Range. Phillaur plantation. Changa Manga. It has been suggested that this plant is not indigenous to many parts of India but it appears to be so to the Punjab. Flowers: May–November.

PLUMBAGO CAPENSIS, Thunb.—A sub-scandent shrub. Leaves about 2 by .8 inch, oblong or oblong-spathulate. Flowers 1 inch across, pale blue, in spikes about 2 inches long. Calyx pubescent and glandular in the upper part. Corolla-tube 1.3 inches long, thrice as long as the calyx; lobes obtuse. Otherwise very similar to the above. Indigenous to South Africa. Often grown in gardens in the plains. At Abbottabad it is apt to get cut back by frost.

LIII. MYRSINACEÆ.

Trees or shrubs. Leaves alternate, usually coriaceous and gland-dotted, simple; stipules 0. Flowers small, regular, 1- or 2-sexual, 4-5-merous. Calyx usually free, persistent. Petals united into a short or long tube, rarely free, contorted or imbricate, rarely valvate. Stamens as many as and opposite the petals, free or more or less connate, adnate to the base of or inserted on the corolla; anthers 2-celled, introrse or extrorse. Ovary superior, rarely inferior or half-inferior, 1-celled; ovules few or many, on a basal or free-central usually globose placenta; style short, simple; stigma simple, rarely lobed. Fruit drupaceous or subbaccate, 1-many-seeded, usually indehiscent. Seeds usually globose and excavate at the base, with pitted or ruminate albumen. **DISTRIB.** A family wholly tropical and subtropical.

Leaves toothed (see also No. 3. *Embelia*).

Leaves thin; calyx adnate to the ovary;
fruit many seeded ... 1. *Mæsa*.

Leaves coriaceous; calyx free from the
ovary; fruit 1-seeded ... 2. *Myrsine*.

Leaves entire (sometimes obscurely serrulate in *Embelia*).

Leaves thin; petals free; fruit dry 3. *Embelia*.

Leaves rather fleshy; petals connate; fruit
succulent ... 4. *Ardisia*.

1. *MÆSA*, Forsk.

[From *Maas*, the Arabic name of one of the species. **DISTRIB.** Species 202 (according to Mez. in Engler's *Pflanzenreich*), throughout the tropics except America.]

MÆSA INDICA, Wall. in Roxb. Fl. Ind. ed. Carey II (1824) p. 230, in note.—A large shrub with long straggling branches, twigs usually with numerous small lenticels. Leaves 3-6 by 1-2 inches, lanceolate or oblong-lanceolate, acuminate, distantly serrate-dentate, membranous, glabrous above, glabrous or nearly so and pale beneath, lateral nerves 5-10 pairs; petiole .5 inch long. Flowers .2 inch across, white, in simple or compound axillary racemes 1-3 inches long; pedicels .05-.1 inch long, slender; bracts one at the base of each pedicel, .05 inch long, lanceolate; bracteoles 2 below the calyx, less than .05 inch long, ovate, acute. Calyx .07 inch long, tube adnate

to the ovary; lobes 5, rounded, ciliolate, imbricate. Corolla twice as long as the calyx, 5-fid, lobes rounded. Stamens 5, inserted on the corolla-tube; filaments short, anthers ellipsoid. Ovary half-inferior; ovules many; stigma minutely fid. Berry .15 inch diameter, globose, pinkish-white, succulent, almost covered by the persistent calyx and usually tipped with the style.

Kangra District (fide Lace in Kangra Working Plan). I have seen no Punjab specimens. The plant is common east of the Jumna in the Sub-Himalayan tract ascending to 5,000 feet. Flowers: January—April. Mez l.c. splits *M. indica*, Wall. into 7 species but he does not appear to have been followed in this by any Indian Botanist. The United Provinces specimens appear to be *M. Martiana*, Mez.

2. MYRSINE, Linn.

(From *Mursine*, the Greek name for the Myrtle, *Myrtus communis*.)

Trees or shrubs, usually glabrous. Leaves coriaceous, entire or toothed. Flowers small, in sessile or shortly pedunculate axillary fascicles, polygamous or diœcious. Calyx free. Petals connate or free, imbricate or valvate, inserted at the base of the corolla. Ovary free; ovules few or many, immersed in the placenta; style short or subobsolete; stigmas 2-5, erect or spreading. Fruit small, globose, red or purple, 1-seeded, albumen pitted. DISTRIB. Species 140 (Mez l. c. *Myrsine* 4, *Rapanca* 136); chiefly tropical and mostly Asiatic.

- | | | | |
|--|-----|-----|----------------------------|
| A small shrub; leaves .5-1 inch long;
flowers subsessile | ... | ... | 1. <i>M. africana</i> . |
| A large shrub or small tree; leaves 2-5 inches long; flowers pedicellate | ... | ... | 2. <i>M. semiserrata</i> . |

1. MYRSINE AFRICANA, Linn. *Sp. Pl.* (1753) p. 196.—A small gregarious evergreen shrub, twigs slender pubescent. Leaves .5-1 inch long, lanceolate or obovate, sharply toothed, dotted with resinous glands when quite young, minutely puberulous on the midrib above otherwise glabrous; petiole minute, pubescent. Flowers minute, sub-sessile, in axillary clusters of 3-8. Calyx and corolla 4-lobed. Anthers purple. Style short; stigma large, verrucose. Drupe .15 inch diameter, globose, dark-red, dull, supported by the persistent calyx and tipped by the base of the style. Collett, *Fl. Siml.* fig. 94. Vern. *Kukan* (Haz.), *khokhal* (Rp.), *chota mehdru* (Ka), *chitring* (Kun).

Himalaya 2-9,000 feet. Trans-Indus to Nepal. Salt Range. Very common in forest undergrowth. The shrub is very inflammable burning fiercely when green but being usually less than 4 feet high it is not objectionable in forest undergrowth. The fruit is sold in the bazaar under the name *bebrang* and is used as an anthelmintic. Flowers: March—May.

2. MYRSINE SEMISERRATA, Wall. in *Roxb. Fl. Ind. ed. Carey* II (1824) p. 293.—A shrub or small tree, bark ash-colored

or nearly black, branchlets pubescent at the tips. Leaves 2.5 by .5-1.2 inches, lanceolate, sharply serrate, rarely entire, dotted with resinous glands near the margin on the lower surface, glabrous; petiole .1-.3 inch long, glabrous. Flowers .1 inch across, in dense axillary fascicles; pedicels .05-.1 inch long (in Western specimens). Calyx and corolla 4- rarely 5-lobed. Anthers tinged with pink. Style short; stigma 2-3-lobed, lobes flat, spreading, fimbriate. Drupe .2 inch diameter, globose, bright reddish-purple, fleshy, supported by the calyx and tipped by the base of the style.

Himalaya 3,000-6,000 feet. Charihan, Rawalpindi; Simla. Has not been collected in Kangra but probably occurs. Flowers: January--May.

3. *EMBELIA*, Burm.

[From the Cinghalese name for one of the species. *DISTRIB.* Species 92 (according to Mez. l.c.); Tropical Asia, Africa and Australasia.]

EMBELIA ROBUSTA, *Roxb. Hort. Beng.* (1814) p. 16.--A rambling shrub, young shoots rusty-pubescent, branches with numerous small lenticels. Leaves 2.5-6 by 1.5-3 inches, ovate, elliptic or obovate, acuminate, undulate or serrulate, thin, pale beneath, more or less puberulous especially beneath; petiole .2-.7 inch long, rusty-pubescent and glandular, channelled above. Flowers .2 inch diameter, greenish-white, in axillary and extra-axillary racemes; racemes solitary or 2-3 together, simple or rarely branched .5-4 inches long; pedicels .12 inch long, pubescent; bracts minute, subulate. Calyx .05 inch long, deeply 5-fid; segments ovate, subacute, margins minutely glandular. Petals 5, free, .1 inch long, slightly puberulous and with a few glands outside, densely papillose within, oblong, tips reflexed, imbricate. Stamens 5, adnate to the base of the petals and exerted in male flowers; anthers minutely apiculate. Ovary free; ovules few, on a subglobose placenta; style short; stigma capitellate. Drupe .15 inch diameter, globose, red, tipped by the style and seated on the persistent calyx. Seed 1, albumen pitted.

Sub-Himalayan tract. Not common but occurs in the undergrowth of *Pinus longifolia* forests near Punjab, Rawalpindi; also in Kangra. Flowers July--September.

4. *ARDISIA*, Swartz.

[From the Greek *ardis*, a point; referring to the anthers. *DISTRIB.* Species 235 (according to Mez. l.c.); tropical, most abundant in Asia.]

ARDISIA SOLANACEA, *Roxb. Cor. Pl.* I (1795) p. 27, t. 27.--A large evergreen glabrous shrub, twigs stout. Leaves 4-8 by 1.5-3.5 inches, oblanceolate or obovate, acute or shortly acuminate, entire, rather thick, soft and fleshy, base narrowed; petiole .2-.5 inch long, stout, channelled. Flowers .6-.8 inch across,

pink or pinkish-white, waxy, in axillary pedunculate elongate or contracted racemes 1·5-5 inches long; pedicels 1-1·3 inches long, slightly thickened towards the top; bracts 1-1·2 inch long, ovate, gland-dotted, caducous. Calyx divided to the base; lobes 5, 2 inch long, rotund-ovate, gland-dotted, margin membranous, ciliate, imbricate. Corolla divided nearly to the base; lobes 5, 4-5 inch long, ovate-elliptic, acute, spreading, twisted to the right in bud. Stamens 5, adnate to the base of the corolla; filaments short; anthers lanceolate, very acute, cells introrse, dehiscing longitudinally. Ovary ovoid; ovules few, immersed in a globose placenta; style filiform; stigma minute. Fruit 3-5 inch diameter, depressed-globose, black when ripe, full of pink juice, supported by the persistent calyx and tipped with the base of the style. Seed 1, dull-brown, striate, with a small excavation at the base. *A. humilis*, Clarke, in Fl. Brit. Ind. III, p. 529, *ex parte*.

Not common in the Punjab but occurs near Pundwar, District Kangra, in moist ravines. Flowers: mostly March—May. Grown in gardens in Lahore.

ARDISIA PICKERINGIA, Torr. & Gray. - An evergreen shrub. Leaves 2-4 inches long, usually oblanceolate, thickish, entire, glabrous. Flowers 3 inch long, in terminal panicles. Fruit 2 inch diameter, globose.

Indigenous to Florida. Grown occasionally in gardens in the plains. Flowers: September—October.

LIV. SAPOTACEÆ.

Trees, less commonly shrubs, with milky juice (except *Monothea*). Leaves alternate, simple, entire, usually coriaceous; stipules usually wanting. Flowers usually bisexual, small, regular, axillary. Sepals 4, 6 or 8 in two series, or 5, free or slightly connate at the base, persistent. Corolla gamopetalous; tube short, campanulate or urceolate; lobes as many as sepals and uniseriate, or twice as many and biseriate, sometimes branched with appendages so as to appear many-seriate. Stamens inserted on the corolla-tube, as many as the corolla-lobes and opposite to them, or 2-3-times as many, 1-3-seriate; filaments usually short; anthers oblong-lanceolate, the connectives often produced; cells usually extrose, dehiscing lengthwise. Ovary superior, 1-12-celled; ovules solitary in each cell; style shortly conical or elongate subulate; stigma minute. Berry 1-8-seeded. Seeds ellipsoid, compressed if more than one, shining, smooth.

DISTRIB. A fairly small family; mainly tropical.

- | | |
|--|----------------------|
| A large tree, unarmed; filaments short; | |
| ovary 4-12-celled | 1. <i>Bassia</i> . |
| A thorny shrub; filaments long; ovary 1-celled | 2. <i>Monothea</i> . |

1. *BASSIA*, Koenig ex Linn.

(In honor of Ferdinando Bassi, a Curator of the Botanic Gardens at Bologna. **DISTRIB.** Species 30; India and Malaya.)

BASSIA LATIFOLIA, Roxb. *Cor. Pl.* I (1795) p. 20, t. 19.—A deciduous tree; bark grey, brown or blackish, with shallow wrinkles and cracks; young shoots pubescent or tomentose. Leaves clustered near the ends of the branches, 5-7 by 3-4 inches, elliptic or elliptic-oblong, shortly acuminate, pubescent or tomentose when young, ultimately glabrous or nearly so, coriaceous; lateral nerves 10-12 pairs; petiole 1-1·5 inches long; stipules 2-3 inch long, subulate, densely pubescent, fugacious. Flowers ½ inch across, cream-colored, in dense fascicles near the ends of the branches below the terminal leaf-bud; pedicels 1-1·5 inches long, drooping, rusty-pubescent or tomentose. Calyx usually 4-lobed, divided almost to the base: lobes coriaceous, rusty-tomentose, ¼-⅙ inch long, elliptic or oblong, the two outer subvalvate and enclosing the others. Corolla ⅙-⅛ inch long, fleshy, tube ovoid, limb 7-14-, usually 8-9-lobed; lobes ovate-lanceolate, acute, erect. Stamens 20-30, usually 24-26, 3-seriate; anthers subsessile, lanceolate from a cordate base, acuminate, hairy at the back, shorter than the corolla-lobes. Ovary 4-12-celled, hirsute; style 1 inch long or more, subulate, hairy at the base. Berry 1-2 inches long, green, fleshy, ovoid. Seeds 1-4, ½ inch long, polished. Vern. *Mohwa*, *mehwa*.

Sub-Himalayan tract from the Ravi eastwards, cultivated. Also occasionally cultivated in gardens in the plains. The tree is grown for its flowers the corollas of which are eaten raw or cooked. They are also used for making spirit. The seeds yield an oil used for adulterating ghi. The tree is apparently not wild in the Punjab though as it has been long introduced it is apt to be taken as such in Kangra. Heartwood reddish-brown, strong, tough and durable, sap-wood large. Flowers: March—April, when the tree is leafless or nearly so.

2. MONOTHECA, A. DC. (*Reptonia*, A. DC.).

(From the Greek *monos*, one alone, and *thece*, a case; referring to the one-celled ovary. **DISTRIB.** Species 1; from Western India to Muscat.)

MONOTHECA BUXIFOLIA, Dcne. (*REPTONIA BUXIFOLIA*, A. DC. in DC. *Prodr.* VIII (1844) p. 153.—An evergreen thorny shrub or small tree, bark dark grey, tessellated by deep longitudinal and transverse cracks; thorns axillary and terminal, sharp, straight; young shoots densely grey-pubescent. Leaves 5-1·7 by ½-⅙ inch, elliptic, elliptic-oblong or elliptic-obovate, thick, coriaceous, margins thickened, pubescent when young, glabrous when mature, dark-green above pale beneath; petiole up to ¼ inch long; stipules 0. Flowers ½ inch across, greenish, in axillary fascicles; pedicels and bracts minute. Calyx nearly ¼ inch long, 5-partite, segments elliptic, thick, convex, pubescent externally, imbricate. Corolla ¼ inch long, 5-lobed, lobes as long as the tube, contorted. Stamens 5, inserted on the corolla-tube and opposite its lobes, exserted, alternating with

5 linear-subulate staminodes; filaments subulate; anthers versatile. Ovary 1-celled, densely hairy; ovules 5-7, basal; style subulate, elongate; stigma minute. Drupe .4 inch diameter, globose, somewhat succulent, usually 1-seeded. Seed peltate, hilum broadly excavate, albumen ruminant. Vern. *Gúrgúra*.

Western portion of the Salt Range, Kala-Chitta Hills. Rare in Hazara. Very common Trans-Indus. A plant of dry rocky hills associated with Olive, *Acacia modesta*, *Sageretia Brandrethiana*, &c. The wood is light-brown with an irregular purplish-brown heart-wood. It is very hard, heavy and even-grained. The sweet pulp of the fruit is edible but there is not much of it. Flowers fragrant, April-May.

This genus was formerly included under the Myrsinaceæ but has been shown to belong to the Sapotaceæ by Radlkofer. It differs from the rest of the Sapotaceæ in having long filaments and no latex.

MIMUSOPS, *Linn.*—Evergreen trees. Leaves coriaceous; stipules small, subulate, caducous. Flowers axillary, solitary or fascicled. Sepals 6-8, biseriate, the exterior subvalvate, the interior imbricate. Corolla-tube short, broad; lobes 18 or 24, of which 12 or 16 are exterior and 1-2-seriate and 6 or 8 interior and 1-seriate. Stamens 6 or 8, attached to the corolla and opposite to the lobes of its innermost series; filaments short, dilated, free or connate with the staminodes into a tube; anthers lanceolate, connective usually produced; staminodes 6 or 8, subpetaloid, variously toothed or lacerate, alternating with the stamens. Ovary 6-8-celled, hairy. Fruit a berry, seeds 1-few.

MIMUSOPS ELENGI, *Linn.*—Leaves 2.5-4 by 1.2-2 inches, elliptic, shortly acuminate, shining above; petiole .5-1 inch long. Flowers white, fragrant, nearly 1 inch across, solitary or in fascicles of 2-6. Calyx-segments 8. Corolla-lobes about 24. Berry 1 inch long, ovoid, yellow. Vern. *Maulsari*.

Indigenous to the Western Peninsula. Often grown in gardens in the East Punjab especially in the older gardens and around temples, &c. Less frequent in modern European gardens.

MIMUSOPS HEXANDRA, *Roxb.* Leaves often crowded on short thick subspinescent branches, 2.4-5 by 1.2 inches, obovate, apex rounded or retuse, base cuneate; petiole .5-1 inch long, channelled. Flowers whitish, .3 inch across, solitary or in fascicles of 2-6. Calyx-segments 6. Corolla-lobes usually 18. Berry .5 inch long, reddish-yellow, ovoid. Brandis, Ind. Trees, fig. 163. Vern. *Khirni*.

Indigenous to the Deccan. Often grown in gardens in the East Punjab and as is the case with *M. Elengi* it is more often seen in native gardens than in modern European ones. Both species are grown as far west as Lahore. They yield useful timber and the fruits can be eaten. The bark is used in native medicine and standing trees are often seen damaged by having the bark removed. Growth very slow.

CHRYSOPHYLLUM CAINITO, *Linn.*—An evergreen tree. Leaves 2-4 inches long, elliptic, densely clothed beneath with reddish silky hairs. Flowers small, in axillary fascicles. The *Star Apple* of the West Indies. Grown in Lahore but does not fruit and is rather sensitive to frost.

LV. EBENACEÆ.

Trees or shrubs. Leaves alternate, rarely opposite or ternate, entire, usually coriaceous; stipules 0. Flowers axillary;

solitary or cymose, usually dioecious, regular; pedicels articulate below the calyx; bracts usually 0. Calyx persistent, often accrescent, lobes 3-7. Corolla gamopetalous; lobes 3-7, twisted to the right, very rarely valvate. Stamens 1-2-3-times as many as the corolla-lobes or indefinite; filaments usually very short, free or united at the base in pairs or in bundles; anthers narrow, erect, basifixed, dehiscing longitudinally, rarely by apical pores, often apiculate and hairy; in female flowers staminodes usually fewer than stamens in male flowers or 0. Ovary superior, 2-16-celled; ovules 1-2 in each cell, pendulous; styles 2-8, free or connate at the base; stigmas small, entire or 2-lobed; in male flowers ovary rudimentary or 0. Fruit coriaceous, indehiscent or rarely opening by valves, 1-few-seeded. Seeds usually oblong, more or less compressed, albumen horny, often ruminant. **DISTRIB.** A small family of the warmer parts of the World.

DIOSPYROS, Linn.

(An old Greek name used by Theophrastus, from *dios*, divine, and *puros*, wheat, i.e., celestial food.)

Flowers usually 4-5-merous, dioecious, rarely polygamous. Corolla-lobes twisted in bud. Staminodes usually present in female flowers. Calyx accrescent in fruit. **DISTRIB.** Species 180; tropics of the whole world, a few extra-tropical.

Leaves often opposite or subopposite; albumen

of seeds ruminant ... 1. *D. tomentosa*.

Leaves alternate; albumen of seeds uniform.

Nearly glabrous; fruit edible ... 2. *D. Lotus*.

More or less pubescent or tomentose; fruit not edible.

Branchlets often spinescent; leaves oblong, base cordate; bark rough ... 3. *D. cordifolia*.

Unarmed; leaves elliptic, base not cordate; bark smooth ... 4. *D. montana*.

1. **DIOSPYROS TOMENTOSA**, Roxb. *Hort. Beng.* (1814) p. 40.—A small or medium-sized deciduous tree; bark dark-grey or blackish, exfoliating in small rectangular scales; young shoots tomentose. Leaves opposite, subopposite or alternate, 3-8 by 2-5 inches, sometimes longer, broadly ovate, elliptic or oblong, base usually rounded, apex usually obtuse, very coriaceous, tomentose when young becoming glabrous above and ultimately glabrescent beneath; petiole .3-.5 inch long, stout. Male flowers .25 inch long, .15 inch across the calyx, in tomentose shortly peduncled simple or branched cymes. Calyx funnel-shaped, tomentose, limb acutely toothed. Corolla tubular, twice as long as the calyx, densely woolly outside, limb shortly lobed. Stamens 12-16, free, included, filaments glabrous, connectives pilose, anthers mucronate. Female flowers .5 inch

long, .4 inch across the calyx, solitary, subsessile or on short thick peduncles. Calyx about .4 inch long, densely tomentose, cleft more than half-way down, lobes with reflexed margins. Corolla as in the male but larger. Stamines 8-10 or fewer, sometimes connate in pairs. Ovary hairy, 4-8-celled; styles 2-3, bifid. Fruit 1-1.5 inches diameter, globose or ovoid, hairy when young, smooth and yellow when ripe. Seeds with a ruminate albumen. Vern. *Tendu, kinnu* (Ka).

Sub-Himalayan tract from the Ravi eastwards. Common, wood hard, whitish-pink, fairly durable. In large trees irregular masses of black heart-wood (ebony) are sometimes found. The tree has a tendency to become gregarious as it reproduces readily by rootsuckers and is not eaten by cattle or goats. It is therefore to be recommended for afforestation work in the sub-Himalayan tract. The fruit is edible when quite ripe. The wood burns emitting showers of sparks. Leafless for a short time in the hot weather. Flowers: May—June.

2. *Diospyros Lotus*, Linn. *Sp. Pl.* (1753) p. 1057.—A small or medium-sized deciduous tree; bark rough, dark brown or black, tessellated; young shoots with a few scattered hairs. Leaves alternate, 3-6 by 1.5-2.5 inches, ovate- or elliptic-oblong, acuminate, base rounded or somewhat narrowed, glabrous except for a few scattered hairs beneath when young, pale or glaucous beneath; petiole .3-.7 inch long. Male flowers .2 inch long, .15 inch across the calyx, sub-sessile, in clusters of 2-3. Calyx .1 inch long, cleft about half way down; lobes spreading, ciliate. Corolla tubular, lobed nearly half-way down; lobes obtuse, ciliate, otherwise glabrous. Stamens 16, in two series, included; filaments short, connective hispid, anthers cuspidate. Female flowers .4 inch long, .6 inch across the calyx, nearly sessile, solitary. Calyx and corolla as in the male but larger. Stamines 8, in 1 series, hairy. Ovary 8-celled, hairy only near the apex; styles 4. Fruit .8 inch long, ovoid, dark-purple with a glaucous bloom. Seeds with uniform albumen. Vern. *amlók*.

Sub-Himalayan tract from the Jhelum westwards, 2,500-6,000 feet. Common in Hazara; Chamba (planted ?); Kulu, cultivated. Quite wild in Hazara and in parts of the Rawalpindi District, but has the appearance of being naturalized rather than indigenous. The wood is grey, moderately hard; used only for fuel. Coppices well and reproduces rather freely from seed in moist places. Often cultivated for its fruits which are eaten fresh or dried. The tree would be worth introducing as a fruit tree in the less dry parts of Kunawar. Reaches 30-40 feet in height, but usually not more than 6 feet in girth. Flowers: May.

3. *Diospyros cordifolia*, Roxb. *Cor. Pl.* I (1795) p. 38, t. 50.—A large deciduous shrub or small tree with a low dense broad crown and usually with hard spinescent dwarf branches on the stem and larger branches; bark dark-grey or black, rough on old stems; young shoots pubescent. Leaves alternate,

1·5-4 by ·5-1·5 inches, oblong, acuminate or sometimes obtuse, base cordate or rounded, thin, softly pubescent on both sides, ultimately glabrescent; petioles up to ·2 inch long. Male flowers ·25 inch long, in axillary pedunculate usually 8-flowered cymes; peduncles ·2-·3 inch long, pedicels ·1 inch long, both slender. Calyx ·1-·15 inch long, pubescent, cleft nearly to the base; lobes ciliate, spreading. Corolla broadly tubular, pubescent externally, lobed nearly half-way down; lobes ovate-oblong, subacute. Stamens 16, in two series of 8, the inner stamens shorter than the outer, opposite to them and connate at the base with them into pairs; anthers subobtusate, pubescent, somewhat exserted. Female flowers ·3-·4 inch long, ·5-·6 inch across the calyx, solitary; peduncles ·2-·5 inch long. Calyx ·3-·4 inch long, cleft almost to the base; lobes ovate-oblong, acute, pubescent. Corolla as in the male but larger and with broader obtuse lobes. Staminodes 9-13. Ovary 8-celled, glabrous; styles 4. Fruit 1 inch diameter or a little more, globose, dark-brown with yellow or reddish blotches when ripe. Albumen not ruminate, somewhat corrugate. Vern. *Bistendu*.

Sub-Himalayan tract from the Ravi eastwards, common. Also occasionally in the plains from Sirsa to Delhi. Used only for firewood. The fruit is bitter and not edible. This tree appears to grow well in dry places and does not suffer from frost. It might be found useful for afforesting areas such as the Pabbi Hills. There are two specimens of different sex in the Paillaur Rest-House compound and seedlings are not infrequent in the Plantation, the seed apparently being distributed by birds or jackals. Flowers: March-May.

4. *Diospyros montana*, Roxb. *Cor. Pl.* I (1795) p. 37, t. 48.—A small tree with rather slender stem and smooth grey bark; young shoots glabrous or pubescent. Leaves alternate, 1·5-5·5 by 1-3 inches, ovate-oblong or elliptic, acute or sub-acuminate, base usually rounded, softly pubescent or tomentose when young ultimately glabrescent; petioles ·1-·3 inch long. Male flowers ·4 inch long, in 3-5-several-flowered cymes; peduncles ·2-·5 inch long; pedicels very short. Calyx ·2 inch long, cleft two-thirds the way down; lobes ovate, acute, ciliate, sub-erect. Corolla urceolate, glabrous, cleft half-way down; lobes oblong, obtuse. Stamens 16, in two series of 8, the inner stamens shorter than the outer, opposite to them and connate with them into pairs; anthers lanceolate, awned, glabrous, half exserted. Female flowers ·5 inch long, ·8 inch across the calyx, solitary; peduncles ·15-·3 inch long, nodding. Calyx ·5 inch long, puberulous, cleft two-thirds the way down; lobes elliptic, obtuse, ciliate. Corolla slightly larger than in the male. Staminodes 2, 4 or 8 in one series. Ovary 8-celled, glabrous; styles 4, bifid. Fruit up to 1 inch diameter, globose, reddish-brown when ripe. Seeds with uniform albumen. *D. Kanjilali*, Duthie in Ind. For. XXXI (1905) p. 307.

Sub-Himalayan tract from the Kangra District eastwards. Not as frequent as *D. tomentosa* or *D. cordifolia*. I have followed Haines in referring *D. Konjilali* to *D. montana*, Roxb.,—vide "A Forest Flora of Chota Nagpur," p. 410. If there is more than one species included under *D. montana*, Roxb., it does not seem possible to separate them in the herbarium and the question is not likely to be satisfactorily settled until the forms have been cultivated and studied. Flowers: April—May.

DIOSPYROS KARI, Linn. f.—A small deciduous tree. Leaves alternate, 4-6 by 2·5-3·5 inches (sometimes 8 or 10 inches long), elliptic or elliptic-ovate, shortly acuminate, base usually narrowed, dark-green and pubescent above, paler and more or less pubescent beneath; petiole 4-6 inch long. Male flowers 3 inch long, 4 inch across the calyx, usually in 3-flowered cymes. Calyx-lobes 4, oblong, obtuse, pubescent. Corolla urceolate, puberulous, lobed half-way down. Stamens normally 16; filaments and connectives hairy. Female flowers about 7 inch long, 1-1·5 inches across the calyx. Calyx-lobes 4, very broadly ovate. Corolla as in the male, but larger and more hairy. Staminodes 8, in two series, the 4 outer larger resembling fertile stamens. Ovary 8-celled; styles 4, bifid. Fruit very variable in size and shape, resembling a tomato.

The *Date-Plum* or *Persimmon* of Japan. Cultivated occasionally, e.g., Lahore; Kulu. Fruits freely in Lahore and some varieties are fully 3 inches across. The fruits require a long time to ripen and look ripe long before they are at their best which is a serious drawback in a country swarming with thieves. Except for this the cultivation of the plant could be extended with advantage. The best varieties are grafted on to seedlings stocks. It does not take well when grafted on to *D. Lotus* stock. Flowers: April.

DIOSPYROS EMBRYOPTERIS, Pers.—A small or medium-sized evergreen tree, glabrous except the inflorescence and very young parts. Leaves alternate, distichous, 5-8 by 1·5-2 inches, oblong, smooth and shining, coriaceous; petiole 5 inch long. Male flowers 4 inch long in 2-7-flowered drooping cymes. Calyx cup-shaped; lobes 4, broadly ovate, pubescent on both sides, ciliate. Corolla tubular, slightly contracted at the throat, densely silky outside, lobes short. Stamens 24-64 (usually 40), in pairs; anthers hairy. Female flowers 5 inch long, 1 inch across the calyx, axillary, solitary. Calyx-lobes dilated at the base, subcordate, erect. Corolla campanulate, deeply lobed. Staminodes 1-12. Ovary 8-celled, hairy; styles 4. Fruit 1·5-3 inches diameter, globose, covered with a deciduous red tomentum.

Sub-Himalayan tract east of the Jumna, S. India, &c. Frequently cultivated in gardens in the plains. Gives a dense shade but grows rather slowly. Flowers: May.

LVI. STYRACEÆ.

Trees or shrubs. Leaves alternate, simple; stipules 0. Flowers usually white, regular, bisexual or sometimes polygamous, in axillary or terminal simple or compound spikes or racemes. Calyx gamosepalous, the tube more or less adnate to the ovary; lobes 5 (rarely 4), sometimes obsolete, imbricate, persistent. Petals as many as the calyx-lobes, rarely twice as many, more or less connate at the base, imbricate (rarely valvate). Stamens in one or more series, adnate to the petals, double their number or indefinite; filaments free or connate; anthers round or linear, dehiscing by slits. Ovary more or less inferior, 2-5-celled; ovules usually 2 on the inner angle of each

cell, pendulous ; style simple, stout or filiform ; stigma capitate, entire or lobed. Fruit drupaceous, usually 1-seeded. Embryo curved or straight. **DISTRIB.** A small family of the warmer regions of Asia.

SYMPLOCOS, Linn.

(From the Greek *sumploke*, a connection ; referring to the stamens **DISTRIB.** Species about 280 ; warm regions of Asia.)

SYMPLOCOS CRATÆGOIDES, *Buch-Ham. ex D. Don, Prodr. Fl. Nep.* (1825) p. 145.—A large shrub or small tree ; bark light-grey, corky, rough on old stems ; young shoots and inflorescence hairy. Leaves 1·5-4 by 1·2 inches, ovate or elliptic, acute or acuminate, base rounded or cuneate, more or less sharply serrate with gland-tipped teeth, pilose on the midrib above when young, glabrous or pilose on the nerves beneath ; petiole ·2-·3 inch long, hairy when young. Flowers ·25 inch across, white, fragrant, in cymose corymbs arranged in axillary and terminal panicles 1·3 inches long ; pedicels slender, variable in length ; bracts small, linear, caducous. Calyx nearly ·1 inch long, tube obconic ; lobes 5, rounded, as long as the tube, ciliate. Petals 5, elliptic, connate at the base. Stamens 20-60, as long as the petals, connate into 5 bundles ; anthers round. Ovary inferior, 2-celled ; style filiform ; stigma small, capitate. Fruit ·25 inch diameter, globose, black when ripe, tipped by the remains of the calyx-limb ; seed usually 1, embryo curved. Collett *Fl. Siml.*, fig. 95. Vern. *Lodar, lojh*.

Himalaya 3-8,000 feet from the Indus eastwards. Not common in Hazara, frequent further east. Reaches 30 feet with a girth of 3-4 feet. Growth slow. Wood white, close-grained, but splits and twists in seasoning, it is not used. The bark and leaves give a yellow dye. The tree is conspicuous when in flower in April—June.

LVII. OLEACEÆ.

Trees or shrubs. Leaves opposite, rarely alternate or whorled, simple, entire or toothed, pinnati-sect or -partite or imparipinnate ; stipules 0. Flowers regular, bisexual, rarely polygamous or dioecious, often dimorphous, in axillary or terminal cymes or panicles, rarely fascicled or racemose. Calyx usually small, campanulate, rarely turbinate or tubular, 4-15-, usually 4-toothed, rarely wanting. Corolla usually gamopetalous, rarely of 4-12 petals or wanting ; tube long or short ; lobes or petals imbricate or induplicate-valvate, rarely contorted. Stamens 2 (in the Indian genera) inserted on the corolla or in poly- and a-petalous genera hypogynous ; filaments usually short ; anthers oblong, 4-celled. Disk 0. Ovary free, 2-celled ; ovules 2 in each cell, rarely 1 or 4-10 ; style short or long ; stigma simple

or 2-lobed. Fruit a berry, drupe, capsule or nut. **DISTRIB.** A family of warm and temperate regions, throughout the globe.

Trees with pinnate leaves ... 1. *Fraxinus*.

Shrubs, or trees with simple leaves.

Shrubs erect with pinnate leaves or scandent
with simple or pinnate leaves ... 2. *Jasminum*.

Erect trees or shrubs with simple leaves.

Fruit capsular.

Leaves very rough; corolla-lobes im-
bricate ... 3. *Nyctanthes*.

Leaves not rough; corolla-lobes in-
duplicate-valvate ... 4. *Syringa*.

Fruit drupaceous.

Petals free or connate in pairs ... 5. *Linociera*.

Corolla gamopetalous.

Inflorescence axillary (except in *O.*
glandulifera); stone usually 1-
seeded ... 6. *Olea*.

Inflorescence terminal; stone 2-4-
seeded ... 7. *Ligustrum*.

1. **FRAXINUS**, Linn.—(The Ashes.)

(The classical name of the Ash.)

Deciduous trees. Leaves opposite, imparipinnate (rarely simple). Flowers small, polygamous or diceious, in lateral or terminal panicles or racemes; bracts caducous. Calyx small; 4-toothed or 0. Corolla 0 or of 4 (2-5) petals which are often united in pairs by the stamens. Stamens 2, attached near the base of the petals or sub-hypogynous. Ovary usually 2-celled: ovules 2 in each cell, pendulous from its apex; style short or long, bifid. Fruit a winged nut, 1-seeded, winged at the top. **DISTRIB.** Species 60-70; North Temperate regions of both hemispheres.

Inflorescence on the young shoots in the axils
of the upper leaves and terminal.

Petal 0 ... 1. *F. micrantha*.

Petals present ... 2. *F. floribunda*.

Inflorescence arising from the shoots of the
previous year in the axils of fallen leaves.

Calyx present below the fruit, flowers fas-
cicled ... 3. *F. xanthoxyloides*.

Calyx 0; flowers racemose ... 4. *F. excelsior*.

1. *FRAXINUS MICRANTHA*, Lingelsh. in Engl. *Botanische Jahrb.* XL (1908) p. 217.—A large deciduous tree; bark grey, smooth on young, corky and furrowed on old stems; young parts and inflorescence puberulous with rusty hairs. Leaves 7-12 inches long (probably often longer on sterile shoots). Leaflets 5-9, 2·5-5 by 1-2 inches, ovate- or lanceolate-oblong, caudate-acuminate, base rounded or cuneate, serrate, pilose along the midrib beneath, otherwise glabrous when mature; petiolules 2-5 inch long (rarely 0 owing to the blade being attenuated into a petiolule-like base). Flowers in lax axillary and terminal panicles on shoots of the current year; pedicels clustered, filiform. Calyx nearly 0·5 inch long, rather more across, cup-shaped, with 4 minute triangular lobes. Petals 0. Anthers large, over 1 inch long, connective produced as a short bristle; filaments as long as the anthers. Ovary covered with black scales. Fruit nearly 1·5 inches long, 25 inch broad, oblong-lanceolate, apex rounded, deeply emarginate (? fully ripe).

Himalaya 6-7,000 feet. Kumaon to Bashahr and probably further west, but I have seen only one Punjab specimen. See remarks under *F. floribunda*.

Dr. Lingelsheim (l. c.) says it is easily distinguished from *F. floribunda* by the almost sessile leaflets. This character is found in the type (Duthie's No. 22,555) but in the other flowering specimens in Herb. Dehra the leaflets are distinctly petiolulate. The lax inflorescence also mentioned as a distinguishing character between this species and *floribunda* does not serve to distinguish all forms of the latter. Flowers: April - May.

2. *FRAXINUS FLORIBUNDA*, Wall. in Roxb. *Fl. Ind. ed. Carey* I (1820) p. 150.—Leaflets glabrous, bases of the lateral leaflets very unequal-sided; petiolules up to 7 inch long. Inflorescence usually denser than in *F. micrantha*. Petals 1 inch long, oblong. Anthers scarcely 1 inch long, apiculate, longer than the filaments. Fruit not seen. Otherwise as for *F. micrantha*.

Himalaya, Nepal, Assam. I have included this tree as it is recorded as occurring in the Punjab in the Fl. Brit. Ind. Except for the presence of petals there is no marked difference between it and *F. micrantha*. All the west Himalayan flowering specimens I have seen belong to *F. micrantha* and not to *F. floribunda*.

3. *FRAXINUS XANTHOXYLOIDES*, Wall. *Cat.* (1828) No. 2833.—A large deciduous shrub or small tree; bark grey, smooth when young, dark and much cracked on old stems; branches stiff. Leaves 3-6 inches long, rachis very narrowly margined. Leaflets 7-9, the terminal sometimes wanting, 5-2 inches long, variable in shape, usually ovate-lanceolate or ovate-oblong, crenate-serrate, glabrous or slightly hairy along the midrib beneath, sessile or the lower narrowed into a short marginate petiolule 2 inch long or less. Flowers appearing

before or with the young leaves on the shoots of the previous year, in dense clusters in the axils of the fallen leaves, clusters surrounded by dark-brown scurfy bracts. Calyx very obscure in the male flowers, less than .05 inch long in bisexual flowers and in fruit, deeply fid. Petals 0. Filaments .2 inch long, anthers less than .1 inch long. Style .15 inch long. Fruit 1.5-2 inches long by .3-.35 inch broad, oblong-oblancheolate, obtuse, emarginate or subacute, on pedicels .3 inch long. Brandis, Ind. Trees, fig. 168. Vern. *Hanuz* (Haz.), *Thum* (Chamba & Bashahr).

Inner valleys of the Himalaya, Kagan 3,500-5,000 feet, Chenab 3,000-9,000 feet, Kunawar 5,000-8,000. Spiti. Locally very common and more or less gregarious. Usually associated with *Acer pentapomicum* and *Quercus Ilex* and characteristic of the inner dry valleys. The growth is slow, the tree reaches a height of 25 feet with a girth of 5-6 feet but it is usually a large shrub 10-15 feet high. The wood is hard, white and close-grained, it is used for tool-handles and walking-sticks. Flowers: April.

4. *FRAXINUS EXCELSIOR*, Linn. *Sp. Pl.* (1753) p. 1057.—A large deciduous tree; bark grey, thick; twigs minutely pubescent when young, buds black. Leaves often in whorls of 3, 7-12 inches long, rachis channelled. Leaflets (3-) 5-7 (-9), 2.5 by .8-2 inches, oblong, oblong-elliptic or -lanceolate, acuminate, serrate, hairy along the midrib beneath, otherwise glabrous when mature, sessile. Flowers appearing before the leaves on shoots of the previous year in the axils of the fallen leaves, in racemes which are solitary or paired; rachis (in fruit) 1-6 inches long. Calyx and petals 0. Filaments very short. Fruit 1.5-2 by .3-.35 inch, narrowed from about the middle, apex acute, obtuse or emarginate. *F. Hookeri*, Wenzig. *The Ash*. Vern. *Sum*.

Himalaya 8-10,000 feet. Wild in Hazara, Kashmir and Chamba. Cultivated in Hazara and grows very well at 4,000 feet, but requires good deep soil. I have seen no Indian specimens showing flowers. The timber is much in demand for making gun carriages but is not plentiful and is difficult to extract. The tree is found scattered in patches of broad-leaved forest where the soil is rich and deep and owing to the high prices obtainable for the timber efforts have been made from time to time to cultivate it. This is done by sowing the seed in nurseries and transplanting the plants when large enough. The seed germinates in the second year after sowing. The plantations made in Hazara are not very promising but from the way the Ash grows in Abbottabad it could probably be profitably cultivated at elevations of 4,000-6,000 provided only deep moist soil were selected. At the higher elevations the growth appears to be slow and extraction of timber is difficult.

The tree above described differs from *F. excelsior* of Europe in having fewer leaflets and longer and more slender racemes and was considered specifically distinct by Wenzig who describes it as *F. Hookeri* in Engl. Bot. Jahrb., IV (1883) p. 179, a view which is adopted by Lingelsheim in his "Vorarbeiten zu einer Monographie der Gattung Fraxinus" in Engl. Bot. Jahrb. XL (1908) p. 223. The trees planted at Kilba, Bashahr and perhaps elsewhere are said to have been imported from Europe by Mr. Baden-Powell and are therefore *F. excelsior* as understood by Lingelsheim.

2. JASMINUM, Linn. (*The Jessamines.*)

(The origin of the name is uncertain, it is said to be from the Greek *ia*, a violet, and *osme*, smell; or from the Arabic name *ysmym*.)

Shrubs erect or scandent. Leaves opposite or alternate, simple or 3-few-foliate. Flowers bisexual, often dimorphous, usually in axillary or terminal 2-3-chotomous cymes. Calyx 4-9-toothed, teeth long or short. Corolla salver-shaped, white, pink or yellow, tube narrow; lobes 4-12, spreading, imbricate. Stamens 2; filaments very short; connectives usually mucronate. Ovary 2-celled; ovules usually 2 in each cell, near the base; style cylindric; stigma linear or capitate, ultimately usually 2-lobed. Berry didymous or simple by suppression. Seeds usually 1 in each carpel. DISTRIB. Species 140-160; Asia, Africa and Australia, mostly tropical or sub-tropical, 1 each in Southern Europe and South America.

Leaves opposite; flowers white or tinged with pink.

Leaves simple.

Cymes lax; calyx-teeth as long as the tube 1. *J. arborescens*.

Cymes dense; calyx-teeth twice as long as the tube ... 2. *J. pubescens*.

Leaves imparipinnate.

Calyx-teeth shorter than the tube ... 3. *J. dispernum*.

Calyx-teeth longer than the tube.

Terminal leaflets much larger than the others, distal pair of leaflets usually not with broad connate bases; leaflets 3-7, the lateral acute... 4. *J. officinale*.

Terminal leaflets not or scarcely larger than the others; distal pair of leaflets with broad connate bases; leaflets 7-11, the lateral usually very obtuse ... 5. *J. grandiflorum*.

Leaves alternate; flowers yellow.

Glabrous or nearly so ... 6. *J. humile*.

Softly pubescent or tomentose ... 7. *J. pubigerum*.

1. JASMINUM ARBORESCENS, Roxb. Hort. Beng. (1814) p. 3.—A large sub-erect shrub with straggling branches. Leaves opposite, simple, 2-3 inches long, ovate or ovate-oblong, acuminate, glabrescent when mature; petiole .4-.8 inch long, rather slender. Flowers 1-1.3 inches across, white, fragrant, in lax trichotomous pubescent panicles. Calyx .2-.3 inch long, hairy; teeth linear-subulate, as long as or rather longer than the tube. Corolla-tube .4-.5 inch long; lobes 9-12, linear-lanceolate, acute. Ripe carpel usually 1, oblong or ellipsoid, often curved, nearly .5 inch long, black.

Along the foot of the Himalaya from the Kangra District eastwards ascending to 3,000 feet. Cultivated in gardens in the plains. The wild specimens are very variable and often have leaves larger and broader than the sizes mentioned above, they are sometimes tomentose when young. Flowers: April—May.

2. *JASMINUM PUBESCENS*, Willd. *Sp. Pl.* I (1797) p. 37.—A scandent shrub; young parts velvety. Leaves opposite, simple, 1-3 by $\cdot 7\text{--}1\cdot 5$ inches, ovate, acute or acuminate, entire, base rounded or cordate, ultimately glabrate above, more or less tomentose or pubescent beneath especially on the nerves; petiole $\cdot 2\text{--}\cdot 4$ inch long, densely tomentose. Flowers $\cdot 7\text{--}1\cdot 5$ inches across, white, fragrant, sessile or nearly so, in dense capitate cymes often at the ends of dwarf lateral branches. Calyx $\cdot 5\text{--}\cdot 6$ inch long, densely rusty tomentose; teeth 6-9, subulate, twice as long as the tube or more. Corolla-tube $\cdot 7\text{--}\cdot 8$ inch long; lobes 6-9, oblong-lanceolate, acute, shorter than the tube. Carpels 1-2, ellipsoid, about $\cdot 5$ inch long, black when ripe, surrounded by the long hairy calyx-teeth.

Sub-Himalayan tract from the Ravi eastwards. Common in hedges and open scrub jungle. Cultivated in gardens in the plains. Flowers: December—April and also during the rains.

3. *JASMINUM DISPERMUM*, Wall. in Roxb. *Fl. Ind. ed. Carey* I (1820) p. 99.—A glabrous twining shrub, branchlets somewhat quadrangular. Leaves opposite, imparipinnate or the upper unifoliate, 2-5 inches long. Leaflets usually 3-5, the terminal 2-4 by $\cdot 7\text{--}1\cdot 7$ inches, lanceolate or ovate-lanceolate, entire; base cordate, rounded or sometimes slightly narrowed, 3-5-nerved; apex long-acuminate; the lateral smaller subsessile or shortly stalked. Flowers $\cdot 6\text{--}\cdot 8$ inch across, white or tinged with pink, in many-flowered axillary cymes and terminal panicles; bracts $\cdot 1$ inch long or less, linear; pedicels $\cdot 1\text{--}\cdot 2$ inch long. Calyx cyathiform, $\cdot 1$ inch long, glabrous; teeth minute, triangular. Corolla-tube $\cdot 5\text{--}\cdot 6$ inch long, lobes 5, ovate, shorter than the tube. Carpels 2, about $\cdot 4$ inch long, ellipsoid, dark-purple when ripe.

Sub-Himalayan tract ascending to 6,000 feet from Kashmir eastwards. Not common, but has been collected in Chamba and Simla. Flowers: April—May.

4. *JASMINUM OFFICINALE*, Linn. *Sp. Pl.* (1753) p. 7.—A twining shrub puberulous when young, branches striate. Leaves opposite, imparipinnate, 2-4 inches long, petiole and rachis narrowly margined. Leaflets 3-7, the terminal 1-3 by $\cdot 4\text{--}1$ inch, usually distinctly larger than the rest, ovate or lanceolate, acuminate; the lateral shorter and relatively broader, acute, sessile or shortly petiolulate, the distal pair sometimes with broad connate bases. Flowers $\cdot 7\text{--}1$ inch across, in terminal few-flowered corymbs or cymes and axillary pedunculate few-flowered cymes shorter than the leaves or the cymes often reduced to a single flower; pedicels of the cyme-flowers $\cdot 3\text{--}\cdot 7$ inch long, those of the solitary and corymb-flowers often much

longer; bracts up to .5 inch long, linear-subulate or narrow-linear. Calyx .3-.7 inch long, puberulous, tube .1-.15 inch long; lobes 5, subulate, 2-4-times as long as the tube. Corolla-tube .5-.7 inch long; lobes 5, ovate or elliptic. Carpels 2, .3-.4 inch long, ellipsoid or subglobose, colorless, translucent. Vern. *Máti*.

Himalaya 3-9,000 feet from the Indus eastwards, common, extending into the inner valleys. Trans-Indus. Flowers: May—July.

5. *JASMINUM GRANDIFLORUM*, *Linn. Sp. Pl. ed. 2* (1762) p. 9.—A large twining nearly glabrous shrub, often seen sub-erect, branches striate. Leaves opposite, imparipinnate, 2-5 inches long, petiole and rachis margined. Leaflets 7-11, the terminal 1-1.5 by .5-.7 inch, larger than the rest but not very markedly so, rhomboid-ovate or -lanceolate, acute or acuminate; the lateral ovate, usually obtuse, mucronate, the distal pair with broad connate bases often confluent with the terminal, the proximal pair shortly petiolulate, the intermediate sessile. Flowers 1-2-1.5 inches across, white, often tinged with pink outside, in lax axillary and terminal cymes longer than the leaves; pedicels .5-1 inch long; bracts, the lower often large, ovate to spatulate-oblong, foliaceous, the upper small, linear. Calyx .2-.4 inch long, glabrous, tube .1 inch long or less; lobes 5, subulate, 2-3 times as long as the tube. Corolla-tube .7-1 inch long; lobes 5, elliptic or obovate. Carpels 2 (not seen ripe). Vern. *Chameli*.

Himalaya 2-4,000 feet. Salt Range. Trans-Indus eastwards to Kumaon. This is perhaps not indigenous to the Punjab, it is far less common than *J. officinale* though very widely cultivated in native gardens. I have seen specimens from Dalhousie and Palampur which may have been escapes from cultivation and from the Salt Range. It is apparently truly wild on the hills of Rajputana and Central India. Brandis Ind. Trees, p. 452, gives Bashahr as one of the localities for this species—his specimens from Bashahr are *J. officinale*. He also (l. c.) gives the Salt Range as a locality for *J. officinale*—Aitchison's specimen in Herb. Dehra is *J. grandiflorum*. Flowers: July—October.

6. *JASMINUM HUMILE*, *Linn. Sp. Pl.* (1753) p. 7.—An erect glabrous shrub, branches green, angular. Leaves alternate, imparipinnate, very variable in size, usually 2-3 inches long, often 6 inches long in cultivated examples, rachis and petiole channelled above. Leaflets 3-5, very variable in size, the terminal usually 1-2 inches long, often in vigorous and cultivated examples 4 inches long, elliptic, ovate or lanceolate; the lateral smaller, sessile or subsessile, rarely petiolulate, acute or obtuse. Flowers .6-1 inch across, yellow, in terminal corymbose panicles; bracts linear; pedicels .2-.6 inch long. Calyx .1-.15 inch long, teeth 5, half as long as the tube

or less. Corolla-tube $\cdot 4\text{--}\cdot 7$ inch long, lobes 5, broad-ovate, obtuse. Carpels 1-2, ellipsoid, $\cdot 3\text{--}\cdot 4$ inch long, colorless, translucent.

Himalaya 4-10,000 feet from the Indus (also Trans-Indus) eastwards extending into the inner valleys of Kagan, Fangi and Kunawar. Common. Often cultivated in gardens in the plains. Very variable in the size and shape of its leaflets. Central and East Himalayan forms referred to *J. humile* by Clarke in Fl. Brit. Ind. III, p. 602, have 5-9 leaflets. Flowers: April-June.

7. *JASMINUM PUBIGERUM*, *D. Don, Prodr. Fl. Nep.* (1825) p. 106.—An erect shrub, branchlets and leaves softly pubescent. Leaflets 3-7. Pedicels and calyx villous, calyx-teeth sometimes rather more than half the length of the calyx-tube, sometimes very short. Otherwise as for *J. humile*.

Himalaya 4-7,000 feet, not common but has been collected near Simla and Abbottabad. Also Trans-Indus and Baluchistan. Cultivated in gardens in the plains. Might well be a hairy variety of *J. humile* as suggested by Clarke in Fl. Brit. Ind., but there are no examples intermediate in hairiness. Flowers: May-July.

JASMINUM SAMBAC, *Ait.*—A straggling shrub. Leaves opposite, simple, $1\cdot 5\text{--}3$ by $1\cdot 1\text{--}1\cdot 5$ inches, broadly ovate or elliptic; petiole $\cdot 1\text{--}\cdot 2$ inch long. Flowers 1 inch across, white, very fragrant, terminal, solitary, or in 3-many-flowered cymes. Calyx $\cdot 4\text{--}\cdot 5$ inch long; teeth 5-9, subulate, hairy, much longer than the tube. Corolla double; tube $\cdot 5$ inch long; lobes very numerous, as long as the tube. Vern. *chameli*.

Cultivated in the plains. The flowers are much used by natives for making garlands. The wild single-flowered form is believed to be indigenous to the Western Peninsula.

JASMINUM NUDIFLOSUM, *Lindl.*—Leaves opposite, 3-foliate. Flowers yellow, appearing when the plant is leafless. Indigenous to Japan. Cultivated in Abbottabad.

JASMINUM RIGIDUM, *Zenker.*—Suberect. Leaves opposite, 2 by $\cdot 7$ inch, the upper acute at both ends, the lower ovate, coriaceous, glabrous, shining. Flowers white, in dense sessile 1-3-flowered cymes.

Indigenous to South India and Ceylon. Cultivated in Lahore. A free flowering ornamental shrub.

3. *NYCTANTHES*, Linn.

(From the Greek *nux*, *nuktos*, night, and *anthos*, a flower; the flowers open in the evening and drop at sunrise. *DISTRIB.* Species 2; one in Sumatra.)

NYCTANTHES ARBOR-TRISTIS, *Linn. Sp. Pl.* (1753) p. 6.—A large deciduous shrub or small tree, bark grey or greenish-white, slightly wrinkled, twigs rough, quadrangular. Leaves opposite, 2-6 by $1\cdot 3\text{--}5$ inches, ovate, acute or acuminate, very rough and scabrid above, roughly pubescent beneath, entire or with a few coarse teeth, base truncate, rounded or cuneate; petiole $\cdot 2\text{--}\cdot 4$ inch long, stout, channelled above, hairy. Flowers $\cdot 7$ inch across, white with an orange-colored tube, very fragrant, in pedunculate bracteate fascicles of 3-5;

peduncles quadrangular, hairy, variable in length, solitary and axillary or in axillary and terminal trichotomous cymes; bracts .25 inch long, obovate, acute, hairy on both sides. Calyx .25 inch long, tubular-campanulate with 5-7 minute teeth, ultimately splitting and falling off, hairy outside, ciliate. Corolla .3-.5 inch long, salver-shaped, glabrous; lobes 5-8, cuneate-obcordate, unequal, contorted, overlapping to the left in bud. Stamens 2; anthers subsessile near the top of the corolla-tube. Ovary 2-celled; ovules 1 in each cell, ascending, anatropous. Capsule .7 inch long and nearly as broad, strongly compressed parallel to the septum, reticulate, splitting when ripe into two 1-seeded cells. Seeds obovate, flat, dull-brown. Vern. *Har-singár, kuri* (Ka).

Sub-Himalayan tract ascending to 4,000 feet. Common as far west as the Ravi. I have also found it in the Jowlian Reserve, Khanpur Range, Hazara, possibly introduced. Often grown in gardens for its flowers. The wood is pale red or pale yellowish-brown, moderately hard, close-grained. Used for fuel for which it is excellent. The plant is of importance owing to the ease with which it regenerates in the Sub-Himalayan tract; it is however eaten by cattle and requires protection from browsing. In Hazara on shallow limestone soil it is not growing as well as *Dodmæa viscosa* and it does not seem to stand drought so well as that species. Except in very dry places it is likely to be useful for afforestation work. Reaches 15-20 feet in height with a diameter of 1 foot. Flowers more or less all the year but especially during the rains.

4. SYRINGA, Linn.

(From the Greek *surinx*, *suringos*, a pipe; the long straight branches with large pith can be used for making reed-pipes. DISTRIB. Species about 25; Eastern Europe to Japan.)

SYRINGA EMODI, Wall. Cat. (1828) No. 2831.—A large deciduous shrub or small tree, glabrous or the young shoots and inflorescence slightly pubescent, lenticels large and conspicuous. Leaves opposite, 3-6 by 1.2-2.2 inches, elliptic-oblong, acute at both ends, thin, membranous, pale beneath, entire; petiole .3-1 inch long, reddish. Flowers .3 inch across, white, with a heavy rather unpleasant smell, in terminal trichotomous panicles about 4 inches long, the lower branches usually axillary; bracts small, linear-oblong or minute, caducous, pedicels .05-.07 inch long. Calyx .1 inch long, campanulate, truncate or 4-toothed, persistent. Corolla salver-shaped; tube .25-.35 inch long, widened slightly upwards; lobes 4, oblong, hooded at the tips. Stamens 2, inserted near the top of the corolla-tube; filaments short. Ovary 2-celled; ovules 2 in each cell, pendulous from its apex; style short; stigma minutely 2-lobed. Capsule about .5 inch long, cylindric, brown, loculicidally 2-valved. Seed linear-oblong, narrowly winged all round, minutely lacunose. Collett, Fl. Siml., fig. 96.

Himalaya 7-12,000 feet from the Indus eastwards. Chiefly on the inner ranges. Usually found growing in well-drained soils composed of rock debris. An ornamental plant when in flower from May—July.

SYRINGA VULGARIS, Linn.—The well-known *lilac* of gardens in Europe is occasionally planted in gardens in hill stations, but I have never seen it growing well. It probably dislikes the heavy rainfall of most hill stations and perhaps requires more lime in the soil.

5. LINOCIERA, Swartz.

(In honor of Geoffroy Linocier, a physician at Tournon and author of 'L'Histoire des Plants,' Paris, 1584. DISTRIB. Species 40; tropics of both hemispheres.)

LINOCIERA INTERMEDIA, Wight, *Icon.* (1850) t. 1245.—A small evergreen tree or large shrub, glabrous. Leaves 4-8 by 1·5-3 inches, elliptic-oblong, acute or acuminate, base narrowed into and decurrent on the petiole, entire, lateral nerves 10-14 pairs, slender, much curved near the margin; petiole ·7-1 inch long. Flowers ·15 inch long, whitish, in axillary or extra axillary trichotomous panicles about 1 inch long; pedicels ·05 inch long; bracts minute. Calyx ·07 inch long, 4-fid, lobes ovate. Petals 4, oblong, sub-obtuse, obscurely united in pairs at the base, induplicate-valvate in bud. Stamens 2; filaments very short; anthers elliptic, the cells separated by the connective, dehiscing laterally. Ovary 2-celled; ovules 2 in each cell, pendulous from its apex; style short, stout; stigma bifid. Drupe ·4-·6 inch long, broadly oblong, obtuse, glaucous, blue when ripe. Seed usually solitary, albumen copious.

Sub-Himalayan tract from the Ravi eastwards. Not common but occurs at Pundwar, Kangra, growing along shady ravines. Flowers: May—June. This plant is var. *R. xburghii*, C. B. Clarke in Fl. Brit. Ind. III, p. 609. It is variable as regards the length of the inflorescence which is very short in N. W. Indian specimens.

6. OLEA, Linn.

(The Latin name of the Olive, *Olea europæa*, Linn.)

Trees or shrubs. Leaves opposite. Flowers small, bisexual, dioecious or polygamous, in axillary or extra-axillary or in a few species in terminal panicles. Calyx short, 4-toothed or -fid. Corolla-tube short; lobes 4, induplicate-valvate or corolla 0. Stamens usually 2, inserted on the corolla-tube or when the corolla is wanting hypogynous; filaments short; anthers dehiscing laterally or introse. Ovary 2-celled; ovules 2 in each cell, attached laterally to the septum or subpendulous; style short; stigma 2-lobed or capitate. Drupe ellipsoid or subglobose; endocarp bony or crustaceous. Seed usually solitary, albuminous. DISTRIB. Species about 35; mostly in S. Africa, India, Australia and Polynesia.

Leaves densely scaly beneath, not glandular in the nerve-axils; inflorescence axillary ... 1. *O. cuspidata*.

Leaves glabrous, nerve-axils glandular; inflorescence terminal or axillary ... 2. *O. glandulifera*.

1. *OLEA CUSPIDATA*, Wall. Cat. (1828) No. 2817.—A medium-sized evergreen tree; bark smooth when young, exfoliating when old in long narrow irregular strips; young shoots, petioles and leaves beneath clothed with minute reddish scales. Leaves 2-4 by .5-1 inch, oblong-lanceolate, entire, cuspidate, coriaceous, dark-green and shining above, lateral nerves invisible on the lower surface of the leaf, obscure on the upper; petiole .1-.2 inch long. Flowers .25 inch across, whitish, bisexual, in axillary trichotomous panicles about half as long as the leaves; pedicels mostly 0; bracts minute, linear, caducous. Calyx .05 inch long, cup-shaped, subtruncate. Corolla-tube short, lobes spreading, ovate, subacute, .1 inch long. Anthers oval, cells separated by the broadly elliptic connective, dehiscing laterally. Style short; stigma large, thickened, bifid. Drupe .2-.3 inch long, ovoid, supported by the persistent calyx, black when ripe, pulp scanty, endocarp bony. *Olea ferruginea*, Royle. *The Indian Olive*, Vern. *Kao*.

Trans-Indus, Salt Range and Outer Himalaya as far east as the Jumna. Also in the Kagan Valley, Chamba and Kunawar ascending to 6,000 feet. Not wild in the plains but often cultivated. This tree is characteristic of the dry hills west of the Jhelum being less common and rather local towards the east. It is gregarious and often associated with *Acaria modesta* and *Monthea buxifolia*. It is occasionally 50 feet high and 10-12 feet in girth. Wood very hard and heavy, heart-wood large, from light-brown to nearly black, clouded and marbled. It is used for turning, ploughs, etc., and very largely for firewood for which it is excellent. Growth slow, reproduction from coppice profuse but by seed usually very scanty. Young plants when met with will on examination usually prove to be rootsuckers, but I have found seedlings coming up in considerable numbers in forests which have been felled over for firewood. The seedlings were found under the shade of bushes, especially under *Carissa spinarum* or under rocks or even on paths. I have never seen seedlings in grassy blanks and sowings in blanks appear to be uniformly unsuccessful. In Lahore the Indian Olive is usually grown from cuttings. Flowers: March to September according to elevation and locality.

2. *OLEA GLANDULIFERA*, Wall. Cat. (1828) No. 2811.—A small or medium-sized evergreen tree; bark grey, uneven, exfoliating in brittle scales; twigs lenticellate, glabrous. Leaves 3-6 by 1.5-2.5 inches, lanceolate, ovate- or oblong-lanceolate, long acuminate, entire, glabrous, lateral nerves slender, easily visible on both surfaces, glandular in the axils beneath; petiole .5-1 inch long. Flowers .3 inch across, white, bisexual, in terminal and axillary trichotomous panicles up to 4 inches long and broad; pedicels .05-.2 inch long or almost 0; bracts minute. Calyx .05 inch long, 4-toothed, teeth ciliate. Corolla-tube short, lobes spreading, oblong, .15 inch long. Anthers large, oval, cells separated by the broadly elliptic connective, dehiscing laterally. Style short; stigma large, globose. Drupe .3-.5 inch long, oblique, ellipsoid, seated on the persistent but

inconspicuous calyx, black when ripe, endocarp bony. Brandis, Ind. Trees, fig. 170. Vern. *Barkao*.

Sub-Himalayan tract from the Indus eastwards ascending to 6,000 feet. Not common. Usually found in moist ravines. Wood hard, reddish-grey, durable, takes a good polish and is not liable to be eaten by insects. The tree is handsome and shady and should be introduced into gardens in the Punjab. Flowers : April—May.

OLEA EUROPEA, Linn.—A small tree much like *O. cuspidata*, Wall. but with dull green leaves which are silvery beneath with a dense layer of scales and often spinescent branchlets.

This tree was introduced into the Botanic Gardens, Calcutta, in 1800 and into the Punjab long before 1870. It has been grown in Lahore ever since but rarely flowers and never fruits. It also suffers much from a woolly blight.

7. *LIGUSTRUM*, Linn.

(The Latin name of some shrub, derived from *ligare*, to bind ; referring to the use made of the flexible branches.)

Shrubs or trees, deciduous or evergreen. Leaves opposite, simple. Flowers white or yellowish, in terminal usually thyrsoid panicles. Calyx campanulate, truncate or shortly 4-toothed. Corolla funnel-shaped or rotate, tube short or long ; lobes 4, induplicate-valvate. Stamens 2, attached to the tube of the corolla ; anthers included or exserted. Ovary 2-celled ; ovules 2 in each cell, pendulous ; styles short or long ; stigma thickened, emarginate or 2-lobed. Drupe globose or ellipsoid, 1-3-seeded ; endocarp crustaceous or thin. Albumen fleshy. **DISTRIB.** Species about 50 ; Europe, Asia and Australia.

LIGUSTRUM COMPACTUM, Hook. f. & Th. ex Decne. in *Fl. des Serres*, XXII (1877) p. 10.—A small glabrous tree, deciduous ; bark grey, smooth ; twigs with scattered lenticels. Leaves very variable, 2-6 by 1-2·5 inches, usually 4-5 by 1·5 inches, oblong, oblong-lanceolate or lanceolate, narrowed to a point, base broadly cuneate or rounded, entire, subcoriaceous, lateral veins 10-12 pairs or in very short leaves about 6 pairs, easily visible on both surfaces ; petiole 1/3-1/2 inch long. Flowers 1/2 inch across, white, in terminal thyrsoid panicles 4-6 inches long with the lower branches in the axils of the upper leaves ; pedicels 1/10-1/8 inch long ; bracts 1/10 inch long, oblong or lanceolate, caducous. Calyx 1/10 inch long, truncate. Corolla 1/8 inch long ; tube funnel-shaped, 1/4 inch long ; lobes oblong. Stamens shorter than the corolla-lobes. Style nearly 1/2 inch long including the fusiform bifid stigma. Drupes 1/2 inch long, ellipsoid, dark bluish-black, glaucous, in dense panicles.

Himalaya 3-6,000 feet from the Beas eastwards. In small gregarious patches on the banks of the Pabar River and scattered here and there in ravines in the Pabar Range forests. It is much lopped for fodder and an undamaged specimen is difficult to find. Flowers : May—June.

LIGUSTRUM NEPALENSE, Wall. is recorded by E. M. Coventry as occurring in the Punjab but I have seen no specimens from west of Garhwal. It is easily recognized by its closely lenticellate twigs, pubescent panicles and globose fruits.

LIGUSTEUM LUCIDUM, Ait.—An evergreen tree or large shrub, bark grey smooth. Leaves 2-4 by 1-2 inches, ovate or elliptic, acute or acuminate, base rounded, coriaceous, shining above, lateral nerves 4-6 pairs, rather inconspicuous beneath; petiole .5-.8 inch long. Inflorescence and flowers as in *L. compactum*. Fruits rather broader than in *L. compactum* and less crowded.

Indigenous to China. Cultivated in gardens in the plains and in the hills. This plant is likely to be met with as an escape between 4,000 and 6,000 feet. In Abbottabad seedlings spring up very freely in gardens under shade of other species but not under the shade of the parent trees. It requires good moist soil for satisfactory growth.

At least three other species of *Ligustrum* are also grown in gardens but they are seldom seen.

OSMANTHUS FRAGRANS, Lour.—An evergreen shrub or small tree, dioecious. Flowers very pale yellow on slender pedicels in axillary clusters, with a strong smell very like apricots. Indigenous to the Himalaya east of the Jumna. Cultivated in Abbottabad.

LVIII. SALVADORACEÆ.

Shrubs or trees, armed or not. Leaves opposite, entire; stipules very small. Flowers small, regular, bisexual or dioecious, in panicked spikes or racemes. Calyx campanulate or ovoid, 2-4-fid. Corolla of 4-5 free or united petals, imbricate or contorted in bud. Stamens 4-5, inserted on the corolla-tube or near the base of the petals; filaments free or connate; anthers ovate. Disk 0 or of glands alternating with the filaments. Ovary superior, 1-2-celled; ovules 1-2 in each cell, erect from its base, anatropous; style short; stigma entire or 2-fid. Fruit a drupe or berry, usually 1-seeded. **DISTRIB.** A small family; tropical and subtropical Asia and Africa.

SALVADORA, Linn.

(In honor of J. Salvador, a Spanish botanist.)

Unarmed evergreen trees. Flowers green, sessile or pedicelled, in axillary and terminal panicles. Calyx campanulate, 4-fid. Petals 4, slightly connate at the base, imbricate or twisted to the right in bud. Disk of 4 scales or glands between the bases of the filaments or 0. Ovary 1-celled; ovules solitary; style almost 0. Drupe globose, supported by the persistent calyx and corolla; endocarp crustaceous. Seeds erect, globose. **DISTRIB.** Species 2; East Africa, Arabia and India.

Leaves .7 inch broad or more; flowers pedicelled ... 1: *S. persica*.

Leaves less than .7 inch broad; flowers sessile ... 2: *S. oleoides*.

1. *SALVADORA PERSICA*, Linn. *Sp. Pl.* (1753) p. 122.—A medium-sized or small tree, sometimes a large shrub, branches drooping with pale almost white bark, bark on the stem thin;

grey, slightly rough. Leaves 1·5-2·5 by ·7-1·3 inches, elliptic-lanceolate or ovate, obtuse, often mucronate, rather thick and fleshy, green or glaucous, base narrowed or rounded; petiole ·5-·7 inch long. Panicles racemose, axillary and terminal, lax, drooping, numerous towards the tips of the branches. Flowers ·15 inch across, pedicels ·05-·15 inch long. Calyx ·05 inch long, cleft half-way down; lobes rounded, ciliate. Corolla cleft nearly to the base; lobes twice as long as the calyx, oblong, obtuse, reflexed. Drupe ·15-·2 inch diameter, globose, smooth, red when ripe.

Plains of the Punjab in the south. Not very common but found in Dera Ghazi Khan, Muzaffargarh, Jhang, Multan and Bahawalpur, wild and planted, cultivated in various places outside its range, *e. g.*, Ferozepore and Delhi. Under favorable circumstances reaches 30-40 feet in height and 6-8 feet in girth and when well grown makes a shady ornamental tree. Wood white, soft, very little used and is a bad fuel. This tree is believed to be the *Mustard Tree* of Scripture. Sometimes called the *Tooth-brush tree*, a translation of its Persian name given owing to its twigs being much used as tooth-sticks. Flowers: November—May.

2. SALVADORA OLEOIDES, *Decaisne, in Jacquem. Voy. Bot.* (1844) p. 140, t. 144.—A large shrub or small tree, branches rather stiff, bark grey, slightly rough. Leaves 1·5-3 by ·2-·5 inch, linear-lanceolate or narrow-oblong, acute or subobtuse, often mucronate, somewhat fleshy, ashy-green, glaucous; petiole ·2-·3 inch long. Spikes paniced, compact, axillary, often clustered and shorter than the leaves. Flowers ·1 inch across. Calyx ·06-·08 inch long, cleft nearly half-way down; lobes rounded, obtuse. Corolla a little longer than the calyx, deeply cleft; lobes obovate-oblong, obtuse. Drupe ·2 inch diameter, subsessile, globose, yellow when ripe. Vern. *Jhal* (West Punjab), *van, wan, pilu* (the fruit).

Throughout the plains of the Punjab except in the moister tract towards the foot of the hills. Abundant and together with *Prosopis spicigera* and *Capparis aphylla* forms the bulk of the vegetation in the Punjab *raths*. It regenerates from seed more freely than its associates except perhaps *Tamarix artier-lata* and seedlings may often be seen coming up under the shade of *Capparis*. They are also not infrequently found growing epiphytically on hollow trees but probably never become established under such conditions. It is not a tall tree but occasionally reaches a girth of 12 feet with a broad low crown. The lower branches often droop and touch the ground and large specimens are commonly surrounded by a ring of independently rooted plants due to seedlings springing up under the shade of the parent. Large specimens cast a dense shade and in the desert tracts in which it grows its shade is appreciated by man and beast. Wood light yellow, moderately hard with a small irregular purple heartwood. Little used for timber and is a bad fuel so that in lands cleared for cultivation it is often not cut. The wood can be used for brick-burning if mixed with other kinds. The fruits are sweet and are eaten. The panicles often bear small clusters of deformed leaves, apparently the work of some insect. Flowers: March—April.

LIX. APOCYNACEÆ.

Trees or erect or twining shrubs, rarely herbs, usually with milky juice. Leaves opposite or whorled, sometimes alternate, entire, stipules 0, but the petioles often glandular in the axils. Flowers bisexual, regular, in terminal or axillary cymes. Calyx inferior, often glandular within at the base, lobes 5 (4), imbricate. Corolla hypogynous, usually rotate or salver-shaped, lobes 5 (4), contorted, rarely valvate. Stamens 5 (4), usually inserted in the corolla-tube, anthers free or adhering to the stigma by the connectives, pollen granular. Disk annular, cupular, or lobed or of glands or 0. Ovary 1-celled, with two parietal placentas or two-celled with axile placentas or of two distinct or connate carpels; style simple or divided at the base only; stigma various with an entire or more usually 2-fid apiculus; ovules 2-many in each cell, rarely solitary. Fruit a dry or fleshy drupe, berry or samara or of two drupes or berries or more usually of 2 free or connate follicles. Seeds various, often with a tuft of hairs. **DISTRIB.** A family mainly tropical.

Anthers free from the stigma.

Leaves alternate.

A small shrub with small flowers ... 1. *Rhazya*.

A large shrub or small tree with large flowers 2. *Thevetia*.

Leaves opposite or whorled.

Armed ... 3. *Carissa*.

Unarmed.

Leaves usually whorled; flowers about 5
inch across ... 4. *Rauwolfia*.

Leaves opposite; flowers 1 inch or more across.

A tree; flowers in terminal sessile cymes 5. *Holarrhena*.

A shrub; flowers in pedunculate cymes
at the forks of the branches ... 6. *Tabernaemontana*.

Anthers adherent to the stigma.

Erect trees or shrubs.

Trees; anthers exserted; leaves opposite 7. *Wrightia*.

Shrubs; anthers included; leaves usually
ternate ... 8. *Nerium*.

Twining shrubs.

Anthers exserted; corolla subrotate ... 9. *Vallaris*.

Anthers included; corolla salver-shaped.

Corolla-tube inflated in the centre, tips
of the corolla-lobes deflexed ... 10. *Ichnocarpus*.

Corolla-tube inflated at the top, corolla-
lobes obliquely truncate ... 11. *Trachelospermum*.

1. *RHAZYA*, Dene.

(From the Arabic name. *DISTRIB.* Species 2; Arabia to Western India.)

RHAZYA STRICTA, Dene. in *Ann. Nat. Sc. sér. 2*, IV (1835) p. 81.—A small erect evergreen shrub 3 feet high, twigs pubescent. Leaves spirally arranged, 3-4 by $\cdot 5\text{--}\cdot 8$ inch, crowded, linear-elliptic, narrow-lanceolate or oblanceolate, narrowed at both ends, puberulous on the midrib, otherwise glabrous, coriaceous, bright yellowish-green, midrib stout, lateral nerves obscure; petiole 0. Flowers $\cdot 15$ inch across, faintly scented, in terminal and axillary pubescent cymes; pedicels short, stout; bracts $\cdot 1$ inch long, lanceolate, acute, pubescent, ciliate. Calyx $\cdot 05$ inch long, deeply cleft; segments 5, ovate, acuminate. Corolla $\cdot 3\text{--}\cdot 6$ inch long, tube inflated in the upper half, glabrous without, throat constricted with hairs, hairy within beneath the stamens; lobes 5, nearly $\cdot 1$ inch long, ovate, apiculate, overlapping to the left in bud. Stamens included, inserted above the middle of the corolla-tube. Disk annular. Ovary of two distinct carpels; style filiform; stigma dome-shaped, apex shortly 2-lobed. Follicles 2, erect, parallel, 2-3 by $\cdot 2$ inch, cylindric, pointed, straight or slightly curved near the top, pale-brown, glabrous, pericarp thin. Seeds $\cdot 3$ inch long, oblong, angular, compressed, shortly winged at the ends, testa rugose with elevated ridges. Vern. *Vena*.

Plains between the Indus and the Jhelum, often gregarious on dry stony ground, rare near the Jhelum, common near the Indus but not extending to the Sub-Himalayan tract. Conspicuous owing to the color of its foliage. Very common Trans-Indus. Flowers: December—March.

2. *THEVETIA*, Linn.

(In honor of Andr. Thevet, a French monk of the 16th century who travelled in Brazil and Guiana. *DISTRIB.* Species 7-8; America from Mexico to Paraguay, 1 naturalized in India.)

THEVETIA NERIIFOLIA, Juss. ex Steud. *Nom. ed. 2*, II (1841) p. 680.—A large, evergreen, glabrous shrub or small tree, 15-20 feet high, 6 inches diameter. Juice milky, poisonous. Leaves spirally arranged, 3-5 by $\cdot 25\text{--}\cdot 4$ inch, crowded, linear, narrowed at both ends, bright green and shining above, margins slightly recurved; petiole minute. Flowers 2 inches across, yellow, in few-flowered, terminal cymes. Peduncle usually very short; pedicels about 1 inch long; bracts variable. Calyx $\cdot 25$ inch long, divided almost to the base; segments 5, narrow, acute, persistent and spreading in fruit, reflexed when the fruit is ripe. Corolla exceeding 2 inches long, tubular at the base, tube $\cdot 5$ inch long, throat campanulate, limb plicate, lobes 5, overlapping to the left in bud. Corona in the throat of the corolla, of 5 scales arching over the stamens. Stamens 5, inserted at the base of the corolla throat, anthers incumbent on the stigma. Disk thick, cup-shaped, accrescent in fruit. Ovary superior,

of 2 free carpels united by their styles ; stigma broad, angular ; ovules 2 in each carpel. Fruit broadly obovate in longitudinal section 1.25 inches long, elliptic in a horizontal cross-section 1.5 inches broad, exocarp fleshy black when ripe, mesocarp bony, longitudinally and transversely divided, endocarp thin, corky ; seeds 4 or fewer by suppression. Vern. *Zard ganira*. *The Yellow Oleander*.

Cultivated in gardens in the plains and fairly frequently near temples in Kangra district. "Naturalized in hot Sutlej Ravines near Bajji Fort," J. R. Drummond mss. Occasionally seen growing spontaneously in the Kangra district. The plant is useful for rest-house gardens as it requires little attention, is easily grown from seed, transplants well and is not touched by cattle or goats. It is in flower most of the year in the plains and throughout the warmer months in the Sub-Himalayan tract. Owing to its immunity from damage by browsing and to the ease with which it is propagated ; it might be found useful for afforestation work in the moister tracts. The wood is moderately hard and the seeds yield an oil used for burning.

3. *CARISSA*, Linn.

(Derived from the Sanskrit name *Oorissa*. DISTRIB. Species about 20 ; Africa, Asia and Australia).

CARISSA SPINARUM, Linn. *Mantiss.* II (1771) App. p. 559.— A spreading evergreen shrub up to 12 feet high, armed where the stem branches with opposite straight or forked thorns which arise from between the petioles, thorns up to 1.5 inches long, sharp, woody. Juice milky, young shoots pubescent. Leaves opposite, .5-2 by .25-.8 inch, elliptic, ovate or suborbicular, usually acute at both ends, mucronate, coriaceous, bright-green above paler beneath, puberulous on the midrib on both sides otherwise usually glabrous ; petiole about .1 inch long. Flowers about .4 inch across, white, often tinged with pink, very sweet scented, in pubescent corymbose cymes at the tips or forks of the branches. Peduncle 0-.5 inch long, sometimes forked, each branch usually 3-flowered ; pedicels .1 inch long ; bracts linear, half the length of the pedicels. Calyx scarcely .1 inch long, divided almost to the base ; lobes 5, lanceolate, acuminate, ciliate. Corolla-tube slender, .3 inch long, slightly swollen below the top ; lobes 5, about half the length of the tube, overlapping to the right, lanceolate, acute, spreading. Stamens 5, at the top of the corolla-tube ; filaments very short ; anthers apiculate by the produced connective. Disk 0. Ovary syncarpous, 2-celled ; ovules 2 in each cell ; style filiform, reaching the base of the stamens ; stigma minutely 2-fid. Berry ellipsoid, .3 inch long, dull dark-purple, full of milky juice, edible. Vern. *Garanda*, *garinda*, *garra*, *karunda*.

Himalaya ascending to 5,000 feet and in the adjacent plains, very common. Flowers April to June, the fruit ripening in the cold season. One of the commonest plants in the scrub forests and as an undergrowth in Chil forests. It is much browsed by sheep and goats but is otherwise of little value as it is

seldom big enough to cut as fuel. In Chil forests its presence is objectionable as the spreading much-branched shoots catch the falling Chil needles and may convert a ground into a crown fire. The plant spreads by root-suckers more readily than by seed.

CARISSA CARANDAS, Linn.—A larger shrub than *C. spinarum*, shoots glabrous. Leaves 1-3 by ½-2 inches, broadly elliptic, rounded at both ends, mucronate, glabrous. Flowers white, scarcely scented, ½ inch across; peduncle ½-¾ inch long. Calyx ¼ inch long, cleft half-way down, lobes acute. Corolla-tube ⅙ inch long, lobes overlapping to the right. Berry ⅕-⅙ inch long, ellipsoid, purplish-black, polished, 4-8-seeded.

Not wild in the Punjab, cultivated in gardens, e.g., Lahore, Delhi; fruit's edible. It makes a good hedge. Said to be wild in S. India but I have seen no specimens quite like the cultivated plant.

CARISSA GRANDIFLORA, A. DC.—A very spreading low shrub. Leaves 1-2 inches long, very thick, broadly ovate or suborbicular. Flowers variable in size, 1-1½ inches across. Calyx ⅓-½ inch long, divided more than half way down, lobes oblong. Corolla-lobes overlapping to the left. Ovules numerous.

Native of South Africa where it is known as the *Natal Plum*. Grown in gardens in India, e.g., Lahore and Saharanpur as *C. Arduina*, a plant which differs amongst other things in having 2 ovules.

4. *RAUWOLFIA*, Linn.

(In honor of Leonhard Rauwolf, a physician and traveller of the 16th century. DISTRIB. Species about 45; tropics of the Old and New World.)

RAUWOLFIA SERPENTINA, Benth. in *Gen. Pl.* II (1876) p. 697.—A small shrub 2 feet high, glabrous. Leaves whorled, 3-7 by 1-2 inches, lanceolate or elliptic-lanceolate, narrowed at both ends, soft and pliable, bright-green above paler beneath; petiole ⅓-⅔ inch long, small glands in the axils likely to be taken for minute stipules. Flowers ⅓ inch across, pink, in terminal or axillary, peduncled many-flowered cymes. Peduncle 1-4 inches long, cymes compact, much-branched; pedicels short, stout, red; bracts minute. Calyx ¼ inch long, red, cleft half-way down, lobes 5, ovate, blunt. Corolla-tube ⅔-⅘ inch long swollen a little above the middle; lobes 5, spreading, ⅓-½ inch long, overlapping to the left in bud. Stamens inserted in the middle of the corolla-tube, filaments very short. Disk cup-shaped, conspicuous. Ovary of 2 connate carpels; style filiform reaching the stamens; stigma large, capitate, calyptriform at the base, tip shortly 2-fid; ovules 2 in each carpel, collateral. Drupe ¼-⅕ inch diameter, single or didymous, red, turning black when fully ripe.

Sub-Himalayan tract from Sirhind eastwards. Flowers: May-June, sometimes at other seasons. I have seen no Punjab specimens. (The genus is said to have an ovary of 2 distinct carpels in the key to the genera of Apocynaceæ in *Fl. Br. Ind.* III., p. 621, and in *Engl. & Prantl, Pflanzenfamilien* but I have found the carpels united, on examining fresh specimens of *R. serpentina* *R. canescens*, Linn.)

5. *HOLARRHENA*, R. Br.

(From the Greek *holos*, entire, whole, and *arren*, male; referring to the anthers being free from the stigma. Species 7-8; tropical Asia and Africa,

HOLARRHENA ANTIDYSENTERICA, Wall. Cat. (1828) No. 1672.—A small deciduous tree, shoots glabrous or pubescent. Leaves opposite, 4-8 by 2-4 inches, broadly ovate, elliptic or elliptic-oblong, acute or acuminate, glabrous or pubescent, lateral nerves 10-16 pairs; petiole .2 inch long or 0. Flowers white or creamy, 1-1.5 inches across, faintly scented, in many-flowered, terminal, sessile, corymbose cymes. Pedicels variable in length; bracts up to .1 inch long, lanceolate, pubescent, ciliate. Calyx .1-1.5 inch long, deeply cleft; lobes 5, linear-lanceolate, pubescent, ciliate. Corolla salver-shaped, puberulous outside, tube .5 inch long, swollen at the base, hairy within, mouth contracted but not closed with hairs; lobes 5, oblong, rounded at the tips, puberulous, overlapping to the right in bud. Stamens 5, inserted near the base of the tube, included, filaments short; anthers free from the stigma, mucronate, cells rounded at the base. Disk 0. Carpels 2, distinct; style short, filiform; stigma oblong; ovules many in each carpel. Follicles 2, distinct, 8-15 by .2-.4 inch, pendulous, slightly curved, cylindrical, pericarp thin often dotted with white specks. Seeds .5 inch long, linear-oblong, light-brown, minutely rugose, marked with a median line on one side; coma .7-1.5 inches long, pale-brown. Vern. *Keor*, *Kewar* (Ka.), *Kura* (Simla), *Conessi bark tree*.

Himalaya, ascending to 3,500 feet and Sub-Himalayan tract from the Chenab eastwards, common. Flowers: May-June. The leaves are not eaten by cattle or goats and the tree spreads readily by root-suckers, consequently it is likely to be useful for reafforesting waste ground. Wood white soft even-grained, used for spoons, plates, etc. The leaves, fruits, seeds and bark are used medicinally, especially the latter for dysentery.

6. *TABERNÆMONTANA*, Linn.

(In honor of James Theodore Tabernæmontanus, of Heidelberg, a physician and botanist of the 16th century. DISTRIB. Species about 110; Tropical Asia, Africa, America, a few in the West Indies and Australia.)

TABERNÆMONTANA CORONARIA, Willd. Enum. Hort. Berol. (1809) p. 275.—A glabrous evergreen dichotomously branched shrub, bark grey, juice milky. Leaves opposite, 3-6 by 1-2 inches, elliptic or elliptic-lanceolate, acuminate, narrowed towards the base, glossy green above paler beneath, soft, margins wavy; petiole .2-.3 inch long. Flowers 1-2 inches across, white, in solitary or twin 1-8-flowered cymes at the bifurcations of the

branches. Peduncle very short to 2 inches long ; pedicels variable. Calyx .15 inch long, 5-cleft, lobes broadly ovate. Corolla salver-shaped, tube slender, .7-1 inch long, swollen below the middle ; lobes 5, spreading, overlapping to the left in bud. Stamens included, inserted below the middle of the corolla-tube ; anthers free, acute, two-lobed at the base. Ovary of 2 distinct carpels ; style filiform, tip 2-lobed, papillose ; ovules numerous, multiseriate. Follicles 2, 1-1.5 inches long by .4 inch, sessile or stipitate, glabrous, divaricate, 1-3-ribbed, orange or bright-red within, narrowed into a slender curved beak. Seeds .3 inch long, irregular in shape, dull-brown and minutely pitted, enclosed in a red pulpy aril. *Ervatamia coronaria*, Stapf. Duthie, Fl. Upper Gang. Plain II, p. 36.

Sub-Himalayan tract from the Ravi eastwards. Cultivated in gardens in the plains. The cultivated plant has often more ovate leaves, larger flowers, fewer flowered cymes and the flowers are usually double. I see no reason to doubt that the plant wild in the Sub-Himalayan tracts is indigenous, it is common and sometimes gregarious in Kangra. The flowers are inodorous by day but sweet-scented by night. Flowers : May—October.

7. WRIGHTIA, R. Br.

(In honor of William Wright, a Scotch physician and botanist who died in 1827.)

Trees or shrubs. Leaves opposite. Flowers red, yellow or white, in terminal or pseudo-axillary cymes. Calyx small, deeply 5-lobed, with glands or scales within. Corolla salver-shaped, tube usually short, with a corona of 5 or 10 usually fimbriate scales in the throat, lobes 5 overlapping to the left. Stamens 5, at the top of the tube, filaments short, dilated ; anthers exserted, sagittate, conniving round and adherent to the stigma, cells with solid spurs at the base. Disk 0. Ovary of 2 free or connate carpels ; style filiform ; stigma ovoid ; ovules many in each carpel. Follicles free or connate. Seeds linear, tip narrowed, naked, base with a deciduous coma. **DISTRIB.** Species 10-12 ; tropical Asia, Africa and Australia.

Leaves glabrous or pubescent ; corymbs lax ;
follicles connate at the tips only or free ... 1. *W. tinctoria*.

Leaves tomentose ; corymbs erect ; follicles
connate throughout their length ... 2. *W. tomentosa*.

1. *WRIGHTIA TINCTORIA*, R. Br. in *Mem. Wern. Soc.* I (1811) p. 74.—A small deciduous tree, twigs glabrous or puberulous. Leaves 3-6 by 1-2 inches, rather variable, usually elliptic or obovate-oblong, acuminate, base acute or rounded, glab-

rous or puberulous, lateral nerves 8-12 pairs; petiole $\cdot 1\text{--}\cdot 2$ inch long. Flowers white, fragrant, 1 inch across, in lax terminal cymes, branches spreading, dichotomous; pedicels slender; bracts $\cdot 1$ inch long or less, ovate. Calyx $\cdot 1$ inch long, pubescent or glabrous; lobes short, rounded. Corolla-tube twice the calyx; lobes narrow-oblong, obtuse. Corona of numerous linear scales, some inserted with the filaments and some on the corolla-lobes. Follicles 2, 10-20 by $\cdot 2\text{--}\cdot 3$ inch, pendulous, distinct, cohering when young at the tips, cylindric, glabrous, striate. Seeds $\cdot 5\text{--}\cdot 7$ inch long, pale-brown, longitudinally ribbed, with a deciduous coma at the base, apex pointed, coma $1\text{--}1\cdot 5$ inches long.

S-E. Punjab; on the Ridge at Delhi. Flowers: July—September. Cultivated in Lahore. This tree is apt to be mistaken for *Holarrhena antidysenterica* which has usually broader leaves, stamens included in the corolla-tube, follicles not united at the tips and seeds with the coma at the apex (*i.e.* the end of the seed towards the tip of the follicle). The leaves yield indigo whence the specific name.

2. *WRIGHTIA TOMENTOSA*, Roem. & Schult. Syst. IV (1819) p. 414.—A small deciduous tree, twigs tomentose when young. Leaves 3-6 by $1\cdot 5\text{--}3$ inches, elliptic, caudate-acuminate, tomentose on both sides, base acute, margins undulate, lateral nerves 8-14 pairs, prominent; petiole $\cdot 1\text{--}\cdot 2$ inch long, glandular in the axil. Flowers white, fading to yellow, 1 inch across, in erect, usually dense, terminal cymes; pedicels tomentose; bracts $\cdot 1$ inch long, ovate, tomentose. Calyx $\cdot 15$ inch long, tomentose, lobes short, rounded. Corolla-tube twice as long as the calyx, lobes oblong, rounded. Corona orange, variable, of 5-10, often lacinate scales. Follicles united into a cylindric pendulous fruit 4-12 by $\cdot 4\text{--}\cdot 6$ inch, grooved at the junction of the carpels, straight, firm, rough with white tubercles. Seeds $\cdot 5$ inch long, slender, pale-brown, ridged on both faces and longitudinally striate, apex pointed; coma at the base $1\cdot 5\text{--}2$ inches long. Vern. *khalāwa*.

Sub-Himalayan tract from the Ravi eastwards. Flowers: May—June. Not uncommon in the Kangra District. Juice milky, white when fresh turning yellowish on exposure.

WRIGHTIA COCCINEA, Sims.—A small deciduous tree. Leaves 3-5 inches long, elliptic or elliptic-lanceolate, caudate-acuminate. Flowers scarlet, $1\cdot 5$ inches across in few-flowered cymes. Sepals $\cdot 25$ inch long, rounded, nearly equalling the corolla-tube. Corolla thick, sub-coriaceous; coronal scales crimson, rounded, crenulate. Anthers large, very hairy on the back. Follicles united, pendulous, turgid, straight, 6-7 by $1\cdot 3$ inches, deeply grooved at the junction of the carpels, densely speckled with white tubercles.

Cultivated occasionally in gardens. It does well in Amritsar.

8. *NERIUM*, Linn.

(From *Nerion*, the Greek name used by Dioscorides for the Oleander, *N. Oleander*, Linn. derived from *neros*, damp, referring to the habitat of the plant. **DISTRIB.** Species 3; closely allied, from the Mediterranean to India.)

NERIUM ODORUM, *Soland. in Hort. Kew. ed. 1, I* (1789) p. 297.—An erect glabrous evergreen shrub with milky juice. Leaves ternate, sometimes opposite, 4-6 by .8-.9 inch, linear-lanceolate, narrowed at both ends, thick, coriaceous, midrib stout, lateral nerves very numerous, slender, at right angles to the midrib; petiole .2-.3 inch long, thick. Flowers 1.5 inches across, red, pink or white, fragrant, in terminal panicles; peduncle and pedicels minutely pubescent; bracts .2-.3 inch long; linear, acute. Calyx .25 inch long, divided nearly to the base; lobes 5, linear, acute, pubescent. Corolla-tube .7 inch long, lower half cylindric hairy within, throat narrow funnel-shaped; lobes 5, spreading, tips rounded, overlapping to the right in bud. Corona of 5 scales in the throat of the corolla, each scale cleft into 3-7 linear segments. Stamens at the top of the corolla-tube, included; filaments short; anthers conniving round and adhering to the stigma, cells spurred at the base, the spurs curved; connectives hairy on the backs, produced upwards into long thread-like hairy appendages. Disk 0. Ovary of 2 distinct carpels; style filiform, thickened upwards; stigma furnished with a 5-lobed reflected membrane surmounted by 5 tubercles, tip minutely 2-lobed. Follicles connate, 5-8 by .3 inch, erect, straight, longitudinally striate, pericarp thin. Seeds .2 inch long oblong, densely villous, tipped with a coma of brown hairs .5 inch long. The *Oleander*. Vern. *Ganra*.

In the beds of streams in the Himalaya ascending to 5,000 feet and in the Sub-Himalayan tract. Flowers: April to October. A very common and characteristic plant of the banks of streams, not extending far into the Punjab Plains, Salt Range. Common Trans-Indus. The plant is very poisonous and is not eaten by cattle or goats. It is frequently grown in gardens with single or double flowers, the double pink variety being perhaps the favorite.

9. *VALLARIS*, Burm.

(From *vallo*, I enclose, owing to some species being used for screens in Java. **DISTRIB.** Species 5-6; India and Malaya.)

VALLARIS HEYNEI, *Spreng. Syst. I* (1825) p. 635.—A tall evergreen twining shrub with copious milky juice, branches grey, rough with raised lenticels, young shoots glabrous or pubescent. Leaves opposite, 2-4 by 1-1.7 inches, elliptic or oblong-lanceolate, acuminate, bright-green, soft, glabrous or nearly so, base acute, margins undulate; petioles .3-.5 inch long, with numerous subulate-conical glands in the axils. Flowers .7 inch across, white, fragrant, in 3-10-flowered lax axillary

cymes. Peduncle and pedicels pubescent; bracts .2-.4 inch long, linear-lanceolate. Calyx .25 inch long, pubescent, deeply 5-cleft; lobes oblong, acute. Corolla sub-rotate, finely pubescent externally, tube .15 inch long, limb divided about half-way down; lobes 5, rounded, overlapping to the right in bud, throat naked. Stamens 5, inserted at the top of the corolla-tube, filaments broad, pubescent, anthers exerted, acute, connivent in a cone. Disk of 5, oblong, ciliate lobes. Ovary of 2 connate carpels; style filiform, pubescent; stigma thick; ovules many in each carpel. Fruit of 2 connate follicles 4-6 by 1-1.5 inches, straight, pointed, striate. Seeds .5 inch long, ovoid, beaked; coma .7 inch long.

Himalaya ascending to 5,000 feet and Sub-Himalayan tract from the Ravi eastwards, fairly common. Occasionally found in the plains, *e.g.*, Phillaur Plantation. Sometimes grown in gardens. Flowers: December—June.

10. ICHNOCARPUS, R. Br.

(From the Greek *ichnos*, a vestige, and *carpos*, a fruit; referring to the slender follicles. **DISTRIB.** Species 5-6; India to the Philippines and Australia.)

ICHNOCARPUS FRUTESCENS, R. Br. in Mem. Wern. Soc. 1 (1809) p. 62.—An extensive evergreen twining shrub with milky juice, shoots rusty pubescent when young. Leaves opposite, 1.5-4 by .7-2 inches, elliptic, acute, base acute or rounded, glabrous and dark-green above, sparsely adpressed hairy and paler beneath, lateral nerves 4-5 pairs, arching; petiole .1-.2 inch long, puberulous. Flowers .3 inch across, greenish-white, scented, in many-flowered, axillary and terminal panicles. Peduncle and pedicels rusty-pubescent, bracts minute. Calyx .07 inch long, pubescent, cleft half-way down; lobes 5, ovate, acute. Corolla-tube .1 inch long, globosely inflated in the centre over the stamens, much contracted and thickened at the mouth; lobes 5, .2 inch long, pubescent, with white hairs on the upper side near the base, broad and oblong at the base, produced at the tip into a long twisted acumen which is deflexed in bud and flower, overlapping to the right. Stamens 5, included, inserted below the middle of the corolla-tube; filaments short; anthers apiculate, cells spurred at the base, conniving over and adhering to the stigma. Disk of 5 erect, slender clavate lobes, longer than the ovary. Ovary half-inferior, of 2 separate, hairy carpels; style short; stigma very thick produced into a long beak; ovules many in each carpel. Follicles solitary or twin, 4-6 by .2 inch, straight or curved, very slender, cylindric, rusty-pubescent when young. Seeds .5-.7 inch long, very slender, black; coma as long as the seed, scanty. Vern. *bakkar bal*.

Sub-Himalayan tract from the Ravi eastwards, common in hedges. Flowers: August–December.

11. TRACHELOSPERMUM, Lem.

(From the Greek, *trachelos*, a neck, and *sperma*, a seed. **DISTRIB.** Species 6; India to Japan.)

TRACHELOSPERMUM FRAGRANS, Hook. f. in *Fl. Brit. Ind.* III (1882) p. 667.—An evergreen twining shrub, young shoots slightly pubescent, juice milky. Leaves opposite, 2-6 by 7-2 inches, elliptic-lanceolate, acuminate, glabrous, bright-green above, paler beneath, lateral nerves 10-15 pairs; petiole 2-4 inch long, puberulous, glandular in the axil. Flowers 4 inch across, white, fragrant, in lax terminal or axillary, trichotomous panicles. Peduncle and pedicels glabrous; bracts minute. Calyx nearly 1 inch long, cleft almost to the base; lobes ovate, blunt, ciliate. Corolla-tube about 4 inch long, very slender below, inflated at the top, glabrous within and without, mouth thickened, hairy; lobes 5, spreading, cuneate below, obliquely truncate at the apex, hairy near the base above, overlapping to the right, twisted to the left. Stamens 5, included, inserted near the top of the corolla-tube, filaments very short, anthers conniving over and adhering to the stigma, with membranous tips, cells spurred at the base. Disk of 5 erect, quadrate lobes, nearly as long as the ovary. Ovary of 2 distinct glabrous carpels; style filiform; stigma columnar; ovules many in each carpel. Follicles 6-12 by 2 inch, incurved and converging, cylindric, narrowed at each end, pericarp thin, smooth. Seeds 7 inch long, linear, flattened, dull-brown; coma copious, 1 inch long. Collett, *Fl. Siml.*, fig. 97.

Himalaya and Sub-Himalayan tract 2,000-6,000 feet from the Indus eastwards. Not common. Grows over rocks or on the ground climbing over bushes. Kumalgali, &c., Hazara; Rawalpindi near the Jhelum; Chamba; Taklech, Bashahr; Lansdowne Falls, Simla. Flowers: April—July.

TRACHELOSPERMUM JASMINOIDES, Lem.—A species from China and Japan is grown in gardens and is apt to be mistaken for *T. fragrans*. It differs in having the lobes and mouth of the corolla-tube glabrous. The upper portion of the corolla-tube is slightly hairy within above the anthers. Follicles 2.5-3 inches long, straight, divaricate. Flowers: March—April.

VINCA ROSEA, Linn.—A small evergreen shrub 2-3 feet high. Leaves opposite, 1.5-2 inches long, obovate, glossy-green above. Flowers 1-1.5 inches across, rosy or white, in axillary pairs. Corolla salver-shaped, tube 8 inch long, slender, swollen at the top at the insertion of the stamens. Stamens included, almost sessile. Ovary with two glands situated between and exceeding the carpels. Follicle single, 1 inch long by 1 thick. Seeds about .07 inch long, black, tubercled. *Lochnera rosea*, Rehb. A native of the West Indies commonly grown in gardens where it springs up readily self-sown.

VINCA MAJOR, Linn.—A small evergreen shrub, trailing over banks, &c. Leaves opposite, 1-2 by 7-1.5 inches, broadly ovate; petiole 2-5 inch long. Flowers 1-1.5 inches across, blue, solitary, axillary, distinctly peduncled. Corolla salver-shaped, tube 5 inch long, dilated in the upper half. Stamens included, inserted in the middle of the corolla-tube. Disk of two rounded glands alternating with the carpels.

The Periwinkle, a native of Europe, often grown in gardens in the hills and in the plains.

PLUMERIA ACUTIFOLIA, *Poir.*—A small deciduous tree with thick branches and copious milky juice. Leaves spirally arranged, 6-12 inches long, oblong-lanceolate or oblanceolate, with an intramarginal vein, acute at both ends; petiole 1.5-2.5 inches long, stout, glabrous. Flowers 2 inches across, white with a yellow centre, externally tinged with pink, very fragrant, in terminal panicles; peduncles about 5 inches long. Stamens inserted near the base of the corolla-tube, included. Ovary half-inferior. *P. acuminata*, Ait.

A native of Mexico, cultivated in gardens. Leafless throughout the cold season. Does not fruit in Northern India and is propagated by cuttings which should be allowed to wilt before planting and should not be kept too moist at first. Flowers: May.

PLUMERIA OBTUSA, *Linn.*—Similar to the above. Leaves rounded or retuse at the apex; petiole pubescent. Flowers 3.5 inches across, white with a yellowish tinge in the centre; peduncle about 10 inches long.

Indigenous to the West Indies. Cultivated in the plains. In Lahore more often seen than *P. acutifolia*. Flowers: May—July.

ALSTONIA SCHOLARIS, *R. Br.*—A large evergreen tree with milky juice and whorled branches. Leave in whorls of 4-7, 4-8 by 1.5-2.5 inches, oblong-lanceolate or oblanceolate, usually obtuse, pale beneath, with an intramarginal vein; petiole .25-.5 inch long. Flowers .3 inch across, in umbellately corymbose cymes. Corolla salver-shaped, .3 inch long. Stamens included, inserted above the middle of the corolla-tube. Follicles distinct, 12-24 by .2 inch, pendulous, in clusters. Seeds .25 inch long, with a fringe of hairs at each end. *Dita bark tree*.

Indigenous east of the Jumna, cultivated in gardens in the East Punjab. In Lahore it suffers considerably from frost. Flowers: December—March.

BEAUMONTIA GRANDIFLORA, *Wall.*—A large evergreen climbing shrub; juice milky. Leaves opposite, 7-12 by 3-7 inches, obovate-oblong, acuminate. Flowers white, 3-5 inches long, 4 inches across, in terminal cymes. Corolla with a short tube and campanulate throat. Stamens at the top of the tube, included in the throat, anthers horny, sagittate, cells spurred at the base. Follicles united into an oblong, turgid, pendulous fruit 12-18 inches long by 3-3.5 inches diameter. Seeds 1-1.2 inches long; coma 1.5-2 inches long.

Native of Nepal, often cultivated in gardens and propagated by layering or seeds. Flowers: April.

ACOKANTHERA SPECTABILIS, *Hook. f.*—An evergreen shrub, juice milky. Leaves opposite, 2.5-5 by 1-2 inches, elliptic or oblong-lanceolate, glabrous, dark-green above paler beneath; petiole .2-.3 inch long. Flowers white, tinged with pink, fragrant, .3-.5 inch across, in many-flowered dense axillary clusters or corymbs. Corolla salver-shaped, tube .6-.7 inch long, lobes overlapping to the left. Disk 0. Ovary entire. Fruit a purplish-black berry.

Native of S. Africa. A very ornamental plant but contains a deadly poison. Cultivated in Lahore. Flowers: April.

LX. ASCLEPIADACEÆ.

Herbs or shrubs, often twining, usually with milky juice. Leaves opposite or whorled, sometimes obsolete, entire, often with glands at the base of the midrib, stipules 0. Flowers bisexual, regular, 5-merous, usually in umbelliform cymes from the side of the leaf-axils. Calyx inferior, often with minute

glands at the base within, lobes imbricate. Corolla hypogynous, gamopetalous, tube usually short, lobes usually valvate or overlapping to the right. Corona single on the corolla or on the staminal column or double, sometimes minute or wanting, very various in form. Stamens 5, inserted at the base of the corolla, filament free with or without interposed glands or united in a short fleshy column; anthers free or more usually united to the stigma, the margins of the anthers or a basal prolongation below the cells more or less horny, usually projecting downwards as wings on the staminal-column the wings of adjacent anthers nearly meeting, connectives of the anthers often produced into membranous tips; pollen in each cell united into one or two granular or waxy masses, the masses united in pairs or fours to a gland (*corpuscle*) which lies on the edge of the stigma between the anthers. Ovary superior, of two distinct 1-celled carpels enclosed within the staminal-column, their styles united into a stigma which is 5-angled short and included between the anthers or produced beyond them into a long or short, simple or 2-fid beak; ovules usually numerous. Fruit of 2 follicles or 1 by suppression. Seeds usually flat, often margined, crowned with a tuft of long hairs. **DISTRIB.** A large family spread throughout the tropical and subtropical regions of the world, rare in temperate regions.

I. Filaments free; pollen-masses in pairs in each cell, granular.

Flowers small, less than 1 inch across.

Corona of 5, free, fleshy lobes from the middle of the corolla-tube ... 1. *Cryptolepis*.

Corona a 10-lobed ring from near the base of the corolla-tube, often produced behind the stamens into 5 subulate processes ... 2. *Periploca*.

Flowers large, 2 inches across ... 3. *Cryptostegia*.

II.—Filaments connate into a tube; pollen masses solitary in each cell waxy.

A. Anthers with a membranous appendage.

(*) Pollen-masses pendulous (or horizontal)

Corolla-lobes valvate ... 4. *Calotropis*.

Corolla-lobes overlapping to the right.

Corona double, follicles with soft spines 5. *Damia*.

Corona single.

Corona divided almost to the base ... 6. *Pentatropis*.

Corona a low fleshy ring ... 7. *Holostemma*.

Corona various ... { 8. *Tylophora*.
... 9. *Cynanchum*.

(ii) Pollen-masses erect (or horizontal.)

Corolla-lobes overlapping to the right.

Corolla campanulate; coronal-processes subulate, erect ... 10. *Marsdenia*.

Corolla cup-shaped; coronal-processes cuspidate, spreading ... 11. *Dregea*.

Corolla salver-shaped; coronal processes dorsally flattened, erect ... 12. *Pergularia*.

Corolla rotate (or campanulate); corona various. ... 8. *Tylophora*.
... 9. *Cynanchum*.

Corolla-lobes valvate ... 13. *Hoya*.

B.—Anthers without membranous appendages.

Corona double; corolla-lobes pubescent within ... 14. *Leptadenia*.

Corona single; corolla-lobes glabrous within ... 15. *Orthanthera*.

Key to the species from flowering specimens :—

1. { Erect shrubs ... 2.
 { Twining shrubs, or climbing by roots ... 5.
2. { Leafy ... *Calotropis procera*.
 { Leafless or nearly so ... 3.
3. { Branches rigid ... *Periploca aphylla*.
 { Branches flexible ... 4.
4. { Flowers 1 inch long ... *Leptadenia Spartium*.
 { Flowers 3 inch long ... *Orthanthera viminea*.
5. { Leafy ... 6.
 { Leafless or nearly so ... *Periploca hydaspidis*.
6. { Leaves cordate at the base ... 7.
 { Leaves not cordate at the base ... 14.
7. { Leaves oblong-lanceolate ... *Cynanchum Dalhousiae*.
 { Leaves more ovate ... 8.
8. { Flowers orange, leaves tomentose beneath ... *Marsdenia Roylei*.
 { Not as above ... 9.
9. { Flowers purplish, crimson within ... *Holostemma Rhecdianum*.
 { Flowers not as above ... 10.
10. { Peduncle zigzag bearing umbellate cymes at the angles ... *Tylophora hirsuta*.
 { Peduncle not zigzag ... 11.

- | | | | |
|-----|---|---|---------------------------------------|
| 11. | { | Peduncle 2-6 inches long | ... 12. |
| | { | Peduncle not more than 2 inches long | 13. |
| 12. | { | Flowers yellowish green, corona single | <i>Cynanchum auriculatu</i> n. |
| | { | Flowers white tinged with pink,
corona double | ... <i>Daemia extensa</i> . |
| 13. | { | Corolla cup-shaped | ... <i>Dregea volubilis</i> . |
| | { | Corolla salver-shaped | ... <i>Pergularia pallida</i> . |
| 14. | { | Leaves fleshy, climbing by roots | ... <i>Hoya longifolia</i> . |
| | { | Leaves usually not fleshy, twining | ... 15. |
| 15. | { | Flowers large, 2 inches across | ... <i>Cryptostegia grandiflora</i> . |
| | { | Flowers less than 1 inch across | ... 16. |
| 16. | { | Leaves nearly white beneath with a
conspicuous intramarginal vein | ... <i>Cryptolepis Buchanani</i> . |
| | { | Leaves green beneath, or if pale no
intramarginal vein | ... 17. |
| 17. | { | Peduncle zigzag bearing umbellate
cymes at the angles | ... <i>Tylophora hirsuta</i> . |
| | { | Peduncle straight | ... 18. |
| 18. | { | Stamens with free filaments | ... <i>Periploca calophylla</i> . |
| | { | Stamens with united filaments | ... 19. |
| 19. | { | Corolla cup-shaped, leaves 2.5-6 inches
long | ... <i>Dregea volubilis</i> . |
| | { | Corolla rotate, leaves thick .5-1.5
inches long | ... <i>Pentstemon spiralis</i> . |
| | { | Corolla-tube funnel-shaped, limb
spreading, leaves 1-2 inches long | ... <i>Leptadenia reticulata</i> . |

1. CRYPTOLEPIS, R. Br.

(From the Greek *kruptos*, hidden, and *lepis*, a scale; referring to the coronal scales which close the mouth of the corolla tube and hide the anthers and stigma. DISTRIB. Species about 20; tropical Asia and Africa.)

CRYPTOLEPIS BUCHANANI, *Roem. & Schult. Syst. IV* (1819) p. 409.—A large evergreen glabrous woody twiner with copious milky juice. Branches with loose, purplish-brown, papery bark. Leaves opposite, 3-6 by 1-2.5 inches, elliptic-oblong, apex usually abruptly short-acuminate, dark-green and shining above, nearly white and glaucous beneath, coriaceous, midrib stout, main lateral nerves numerous slender almost at right angles to the midrib and terminating in an intramarginal vein,

blade usually narrowed into the petiole which is $\cdot 3\text{--}\cdot 5$ inch long. Flowers $\cdot 5\text{--}\cdot 7$ inch across, greenish-yellow, in short, axillary, paniculate cymes. Pedicels $\cdot 1$ inch long, bracts ovate, persistent. Calyx glabrous, small, with 5 scale-like glands within, 5-partite, segments ovate. Corolla-tube very short, limb flat; segments linear or linear-lanceolate, acute, $\cdot 2\text{--}\cdot 3$ inch long (thrice the calyx), overlapping to the right in bud, glabrous. Corona of 5 clavate scales, from the middle of the corolla-tube. Stamens inserted near the base of the corolla-tube, filaments short, broad, shortly connate at the base; anthers adhering by the bases to the stigma, connectives produced into fleshy processes connivent over the stigma; pollen-masses granular, cohering in pairs in each cell. Stigma conical, not exerted beyond the anthers. Follicles 2-4 by $\cdot 5\text{--}\cdot 7$ inch in the middle, divaricate. Seeds $\cdot 3$ inch long, compressed, black; coma 1 inch long.

Along the base of the Himalaya from the Indus eastwards ascending to 4,000 feet, common. Salt Range. Flowers: May-June.

2. PERIPLOCA, Linn.

(From the Greek *peripleko*, to wrap round; referring to the twining habit of some species.)

Glabrous twining or erect shrubs, sometimes leafless. Leaves when present opposite. Flowers small or medium-sized, in lax terminal or axillary cymes. Calyx small, 5-glandular within. Corolla rotate; lobes usually bearded within, overlapping to the right. Corona a 10-lobed ring arising from the corolla a little above the stamens, often produced behind the stamens into 5 subulate or branched processes. Stamens 5, within the corolla, filaments short, broad, free; anthers bearded on the back or at the base, conniving over and adherent to the stigma, tips cohering; pollen-masses granular, in pairs in each cell (20 in all). Stigma convex. Follicles cylindric, smooth. Seeds comose. **DISTRIB.** Species 12; S. Europe, Western sub-tropical Asia and tropical Africa.

Leafless or nearly so.

- | | | | |
|-------------------------|-------|-----|---------------------------|
| A stiff erect shrub | ... | ... | 1. <i>P. aphylla</i> . |
| A slender twining shrub | ... | ... | 2. <i>P. hydaspidis</i> . |
| A leafy twining shrub | ' ... | ... | 3. <i>P. calophylla</i> . |

1. PERIPLOCA APHYLLA, *Dcne. in Jacquem. Voy. Bot.* (1844) p. 109, t. 116.—A stiff erect shrub usually leafless, branches smooth green about $\cdot 1$ inch diameter, juice copious, milky. Leaves when present $\cdot 25$ inch long, oblong, acute, thick, nerveless. Flowers $\cdot 3\text{--}\cdot 5$ inch across, green without purple within, fragrant, in small, axillary, often opposite cymes, $\cdot 5\text{--}1$

inch long. Peduncle and pedicels thick, hoary or glabrous; bracts ovate, with scarios margins, breaking off about the middle and leaving the thick basal portion. Calyx 5-partite, glabrous or hoary; lobes broad, obtuse, scarcely .1 inch long. Corolla-tube very short; lobes .15-.2 inch long, oblong, obtuse, reflexed, densely hairy within near the tips. Corona produced into 5 filiform, glabrous, purple processes. Filaments glabrous; anthers bearded on the back. Follicles 2-4 inches long by .2 inch diameter, rigid, woody, on short thick peduncles, widely divergent. Seeds .25 inch long, oblong, compressed; coma 1 inch long. Vern. *bata*.

Salt Range and plains from the Jhelum westwards, dry portions of the sub-Himalayan tract in Rawalpindi and Hazara ascending to 4,000 feet, common. Flowers: March—May. The flower-buds are sometimes eaten. This characteristic Salt Range plant is easily distinguished from the other leafless members of this family by its rigid branches. It is usually 3-4 feet in height.

2. *PERIPLOCA HYDASPIDIS*, *Falc. in Proc. Linn. Soc. I* (1841) p. 115.—A slender glabrous trailing and twining shrub, usually leafless, branches smooth green, .05 inch diameter, jointed at the nodes. Leaves when present up to .6 inch long, linear or lanceolate, shortly petiolate, nerveless. Flowers .3 inch across, yellow, in lax, axillary, trichotomous cymes .7-1.5 inches long. Peduncle and pedicels slender, glabrous; bracts ovate, persistent or breaking off and leaving the thick basal portion. Calyx 5-partite, one-third the length of the corolla; lobes ovate, blunt, ciliate. Corolla-tube minute; lobes .1 inch long, oblong-lanceolate, glabrous without villous within. Corona yellow, produced into 5 filiform, hairy processes. Filaments glabrous; anthers bearded on the back. Follicles 3 inches long, less woody than in *P. aphylla* and on more slender peduncles. Seed not seen.

Lower Kagan Valley, near Paras 4,000 feet. Flowers: September—October. Not a common plant and has not been collected with ripe fruits as yet. It is apt to be mistaken for *Ephedra foliata*, Boiss. when not in flower but is easily distinguished by *Ephedra* having the leaves united at the base into a sheath and not having milky juice.

3. *PERIPLOCA CALOPHYLLA*, *Falc. in Proc. Linn. Soc. I* (1841) p. 115.—A slender evergreen twining shrub, glabrous, branches green when young, older purplish. Leaves 2-4 by .2-.7 inch, linear or lanceolate, caudate-acuminate, glabrous, entire, glossy above paler green beneath, rather thin, lateral nerves very slender and numerous, ending in a nerve just within the margin of the leaf, margin undulate; petiole usually .1 inch long or less. Flowers .3 inch across, yellow or pinkish, in small axillary cymes .5 inch long. Pedicels slender, bracts oblong, caducous. Calyx 5-partite; lobes nearly half as long as

the corolla, broadly ovate, blunt. Corolla-tube very short; lobes .15 inch long, ovate-oblong, blunt, more or less hairy within. Corona of 5 filiform hairy processes. Filaments glabrous, anthers bearded on the back. Follicles 4-8 inches long by .15 inch, straight or slightly curved, firm but not woody, parallel or divergent, not divaricate. Seeds linear, .5 inch long; coma 1-1.5 inches long.

Himalaya from Dalhousie eastwards not common, ascending to 6,000 feet. In moist shady ravines. Flowers: April—May.

3. CRYPTOSTEGIA, R. Br.

(From the Greek *kruptos*, hidden, and *stegain*, to cover; referring to the scales in the corolla-tube. **DISTRIB.** Species 2; climbing shrubs natives of Madagascar.)

CRYPTOSTEGIA GRANDIFLORA, R. Br. in Bot. Reg. (1819) t. 435.—A large evergreen glabrous woody climber, stems up to 6 inches diameter, bark grey, juice copious milky. Leaves opposite, 2-4 by 1.5-2 inches, elliptic, usually abruptly narrowed at both ends, coriaceous, glossy above green beneath, lateral nerves numerous slender arched; petiole .3-.5 inch long, the bases of opposite pairs of petioles joined by a slightly raised line. Flowers about 2 inches across, pinkish-purple, in terminal di- or trichotomous, few-flowered cymes. Peduncle and pedicels stout, hoary or glabrous; bracts caducous. Calyx glabrous or hoary, cleft nearly to the base, lobes ovate-lanceolate, acute, with numerous glands at the base. Corolla funnel-shaped, over 2 inches long, shortly tubular below, throat campanulate; lobes broad, acute, overlapping to the right in bud, glabrous. Corona of 5 scales inserted at the base of the throat, each scale cleft into two, long, subulate segments. Stamens with short filaments, anthers adnate to the stigma, connectives produced into acute processes connivent over the stigma; pollen-masses granular, in pairs in each cell. Ovary half-inferior; stigma convex. Follicles 4-5 inches long by 1 inch broad near the base, woody, angled or winged, divaricate. Seeds .3 inch long, oblong, compressed; coma 1.5 inches long.

A native of Madagascar cultivated in gardens for its flowers and sometimes found as an escape. It is quite naturalized on the ridge at Delhi, near Kalka, Hoshiarpur, &c., as well as near Jaipur (Rajputana) on sandy soils and seems likely to spread. It contains rubber of good quality, but hitherto no satisfactory method of extracting it has been found. Flowers: April—September.

4. CALOTROPIS, R. Br.

(From the Greek *kalos*, beautiful, and *tropis*, the keel of a boat; referring to the shape of the coronal scales. **DISTRIB.** Species 4; Tropical Asia and Africa.)

CALOTROPIS PROCERA, R. Br. in *Ait. Hort. Kew. ed.* 2, II (1811) p. 78.—An erect shrub 6-8 feet high, branching from or near the base; young parts clothed with white cottony tomentum. Leaves opposite, 2-6 by 1·5-4 inches, subsessile, entire, broadly ovate, ovate-oblong, elliptic or obovate, base more or less deeply cordate, apex abruptly acute or short-acuminate, glabrous when mature, dull-green, rather thick and fleshy. Flowers nearly 1 inch across, white outside, purple within, scented, in umbellate cymes which are tomentose when young becoming nearly glabrous. Peduncles axillary, stout, up to 4 inches long; pedicels 5-1·5 inches long. Calyx divided to the base; sepals 2 inch long, acute, ovate. Corolla campanulate, 4·5 inch long, glabrous, divided two-thirds the way down; lobes erect, ovate, acute, valvate in bud. Corona equalling or exceeding the staminal-column, of 5 fleshy, laterally compressed processes adnate to and radiating from the staminal column, base of each process produced into an upcurved, involute spur, the apex bifid, obliquely truncate, the back from above the spur straight or slightly curved away from the staminal column. Anthers short and broad, with broad short membranous inflexed appendages; pollen-masses waxy, solitary in each cell, pendulous. Stigma large, pentagonal, depressed. Follicles 3-4 by 2-3 inches, recurved, turgid, smooth. Seeds 25 inch long, broadly ovate, flat, minutely tomentose, light-brown; coma silky, 1·25 inches long. Vern. *Ak, mundār*.

Abundant in the Sub-Himalayan tract and adjacent plains becoming less common in the more arid regions. Flowers throughout the year but mainly in the cold season. Perhaps the commonest and most conspicuous plant in the Punjab, on fallow land, waste ground, etc.

CALOTROPIS GIGANTEA, R. Br.—A very similar plant but reaching a large size is mentioned as occurring in the Punjab in Fl. Brit. Ind. I have not seen it in the Punjab except under cultivation and there are no specimens in Herb. Dehra. It differs from *C. procera* chiefly in the spreading corolla lobes and in the coronal processes which are hairy, shorter than the staminal column, not bifid but with two small auricles close below the apex, apex of the process more pointed owing to the back curving towards the staminal column from above the spur. I have only seen the plant with white flowers but there is some doubt as to whether the color of the flowers is always different in the two species.

5. *DÆMIA*, R. Br.

[From the Arabic name of one of the species. DISTRIB. Species 4-6; Asia and Africa. (*Vide* note under *Pergularia*).]

DÆMIA EXTENSA, R. Br. in *Mem. Wern. Soc.* I (1811) p. 50.—An extensive slender pubescent twining shrub, foetid when bruised and with copious milky juice. Leaves opposite, 1-3 inches long, broadly ovate or suborbicular, base deeply cordate, with rounded basal auricles which are usually incurved and sometimes meet, apex acuminate, pubescent or nearly glabrous

above, velvety or pubescent on the nerves beneath, thin, membranous, basal nerves 5-7; petiole .5-2 inches long. Flowers about .5 inch across, dull-white, tinged with pink, in peduncled cymes which are first corymbose then racemose. Peduncles solitary at the nodes from between the petioles, 2-6 inches long; pedicels filiform, .5-1 inch long; bracts small, linear, acute. Calyx 5-partite, glandular within; sepals .1 inch long, ovate-lanceolate, pubescent. Corolla .3 inch long, tube short, limb campanulate, divided two-thirds the way down; lobes ovate, slightly hairy near the top without, fringed and hairy near the edge within, overlapping to the right in bud. Corona double, the outer at the base of the staminal-column, annular, with 5 quadrate, erect lobes, the inner of 5 erect, fleshy processes adnate below to the back of the anthers and spurred on the backs, produced above the staminal column into subulate horns incurved high over the stigma. Anthers with membranous inflexed tips; pollen-masses 1 in each cell, compressed, pendulous. Stigma exserted. Follicles reflexed, parallel, 2-3 by .5 inch, lanceolate, long-pointed, covered with long soft prickles. Seeds .3 inch long, ovate, pubescent, narrowly margined; coma 1-1.2 inches long.

Himalaya ascending to 3,000 feet and in the plains. Salt Range. Common. Flowers: January—April. The stems and leaves vary considerably in pubescence, but the plant is always easily recognized by its characteristic fruits.

6. PENTATROPIS (R. Br?), Wight et Arn.

(From the Greek *penta*, five, and *tropis*, the keel of a boat; referring to the shape of the corona. DISTRIB. Species about 6; from Senegal to China, Madagascar and Australia.)

PENTATROPIS SPIRALIS, *Dcne. in Ann. Sc. Nat. sér. 2, IX* (1838) p. 327, t. 11 E.—An extensive slender twining shrub with tuberous roots, branches with rough corky bark, twigs slender glabrous or nearly so. Leaves opposite, .5-1.5 inches long, linear, oblong, ovate or elliptic, acute or obtuse, usually mucronate, thick, fleshy, glabrous or nearly so, lateral nerves obscure; petiole .1-.5 inch long, channelled, puberulous. Flowers .6 inch across, green, in 3-6-flowered umbellate cymes arising singly at the nodes from between the petioles. Peduncle slender up to .2 inch long; pedicels filiform .2-.5 inch long; bracts minute. Calyx 5-partite, minute, lobes ovate, acuminate. Corolla .3-.4 inch long, rotate; buds acuminate with 5 gibbous projections at the base between the lobes; lobes overlapping to the right, twisted to the left, triangular at the base with linear tips, glabrous without minutely pubescent within. Corona arising from a little above the base of the staminal-column,

of 5 laterally compressed lobes, slightly shorter than the column and adnate to the back of the anthers; lobes deltoid-ovate, acute or acuminate. Filaments connate, anthers with membranous tips inflexed over the stigma; pollen-masses solitary in each cell, pendulous, waxy. Stigma subtruncate. Follicles 2-3 by $\cdot 3$ inch, fusiform, tip long slender, smooth. Seeds $\cdot 2$ inch long, ovate, compressed; coma $\cdot 7$ - 1 inch long. *P. cynanchoides*, R. Br. Cooke, Fl. Bomb. Duthie, Fl. Upper Gang. Plain.

Throughout the plains of the Punjab in the dryer parts. Salt Range. Common. Flowers: February. In the Punjab *rakhs* almost every large *Capparis aphylla* bush will be found to have one or more climbers growing over it and of these *P. spiralis* is the commonest. *P. cynanchoides*, R. Br. is the older name, but there is some doubt as to whether the plant referred to by Brown is a *Pentatropis*. Vide Schumann in Engler und Prantl, Pflanzenfamilien, IV, 2, p. 258.

7. HOLOSTEMMA, R. Br.

(From the Greek *holos*, whole, entire, and *stemma*, a chaplet, wreath; referring to the ring-shaped corona. DISTRIB. Species 2; India and China.)

HOLOSTEMMA RHEEDIANUM, Spreng. Syst. I (1825) p. 851.—A twining shrub, branches glabrous, hollow, juice milky. Leaves opposite, 3-5 by 2-3 inches, ovate, deeply cordate with rounded basal lobes, acuminate, margins undulate, upper surface slightly puberulous especially on the nerves and with small conical glands at the base of the midrib, lower surface paler puberulous especially on the nerves, basal nerves 5-7; petiole 1-2 inches long, puberulous, narrowly winged. Flowers $\cdot 5$ - 1 inch across, purplish-crimson within frosted-white or pinkish outside, fragrant, in lax, usually umbelliform, pedunculate cymes arising singly from the side of or from between the petioles. Peduncles $\cdot 5$ - $1 \cdot 5$ inches long; pedicels $\cdot 5$ - 1 inch long; bracts small, ovate. Calyx divided nearly to the base; lobes $\cdot 2$ inch long, ovate, puberulous, ciliate. Corolla $\cdot 4$ - $\cdot 6$ inch long, campanulate, divided two-thirds the way down; lobes thick, ovate-oblong, overlapping to the right in bud. Corona arising from the base of the staminal column, consisting of a fleshy ring $\cdot 1$ inch high. Filaments connate, anthers large, with 10 large stiff horny processes on the backs, decurrent to the base of the column as fleshy wings, anther-tips membranous, inflexed; pollen-masses solitary in each cell, elongate, compressed, pendulous, waxy. Style-apex flat, 5-winged. Follicles 4-5 inches long, oblong, tapering to a blunt point, smooth. Seeds $\cdot 25$ inch long, thin, compressed; coma $\cdot 7$ - 1 inch long.

Himalaya and Siwalik Range from the Sutlej eastwards ascending to 5,000 feet. Flowers: July-September. The flowers are edible. There is a

specimen in Herb. Dehra collected in 1837 by Dr. Falconers's collector "from Rawalpindi to Kala-ki-Serai"; it has not since been collected so far west.

8. **TYLOPHORA**, R. Br.

(From the Greek *tulos*, a swelling, and *phorein*, to bear; referring to the coronal scales.)

Erect or twining perennials, undershrubs or shrubs. Leaves opposite. Flowers small or minute, in umbelliform or racemose cymes. Calyx 5-partite, segments acute. Corolla rotate, 5-partite, lobes slightly overlapping to the right. Corona adnate to the very short staminal column, of 5 fleshy laterally compressed processes usually gibbous at the base. Anthers very small with inflexed tips; pollen-masses one in each cell, minute, globose or ovoid, caudicles horizontal or directed upwards, pollen-masses erect, horizontal or pendulous, waxy. Stigma disciform, 5-angled. Follicles acuminate, smooth. **DISTRIB.** Species about 40; mainly Asiatic also in Africa and Australia.

The position of the pollen-masses, whether erect, horizontal or pendulous varies and cannot be depended upon to distinguish the genus from *Cynanchum*. The distinction lies in the pollen-masses being situated at the base of the pollen-sac in *Cynanchum* and towards the top of the pollen-sac in *Tylophora*, a character which is very difficult to observe.

TYLOPHORA HIRSUTA, Wight, *Contrib.* (1834) p. 49.—A twining shrub, stems densely clothed with spreading hairs. Leaves 2-4 inches long, ovate or ovate-lanceolate, base rounded or slightly cordate, apex acute or acuminate, hairy on both sides especially on the nerves, margins ciliate or sometimes nearly glabrous, basal nerves 1-5; petiole .5-1.5 inches long, stout, channelled, tomentose or sometimes pubescent. Flowers .2-.3 inch across, white or pale-green, in few-flowered, umbellate clusters at the angles of a zig-zag peduncle. Peduncles solitary at the nodes from a little to the side of the leaf-axil, variable in length, villous; pedicels filiform, up to .5 inch long, glabrous; bracts linear, nearly .1 inch long. Calyx-lobes lanceolate, hirsute, half the length of the corolla. Corolla .15 inch long, cleft rather more than half-way down, puberulous within, lobes ovate. Coronal-processes subglobose, not exceeding the staminal-column, wholly adnate to it. Pollen-masses very minute, horizontal. Follicles 2-2.5 by .2-.3 inch, solitary or divaricate, narrowed to a point, thin, smooth. Seed .25 inch long, dark-brown, compressed, apex broadly truncate; coma 1 inch long.

Sub-Himalayan tracts from the Indus eastwards, ascending to 4,000 feet. Not common. Flowers: July—August.

TYLOPHORA GOVANI, *Don.*—An erect perennial with annual woody shoots in habit, foliage and color of flowers very like *Cynanchum Arnottianum*

from which it is best distinguished by the corolla being glabrous within. Pollen-masses pendulous.

Kunawar 7-8,000 feet.

TYLOPHORA TENERRIMA, *Wight*.—A very slender twining perennial with linear leaves 1-2 by 1-3 inch. Flowers purple. Coronal-processes with free incurved cuspidate tips. Pollen-masses horizontal.

Himalaya 3-6,000 feet from Kashmir eastwards.

9. *CYNANCHUM*, Linn.

(From the Greek *kuon*, a dog, and *anchein*, to strangle; referring to the poisonous properties of some species.)

Erect perennials with annual woody shoots or climbers with more or less woody stems or rootstocks. Leaves opposite. Flowers small, in sessile or pedunculate corymbose or umbelliform cymes, rarely racemose. Calyx 5-partite. Corolla rotate or campanulate, 5-partite, lobes overlapping to the right. Corona very variable, arising from near the base of the staminal column, annular, cupular, tubular or lobed or more or less deeply divided. Anthers with a membranous tip, filaments united, tube very short; pollen-masses waxy, pendulous, solitary in each cell. Stigma usually convex. Follicles slender or stout, smooth, sometimes winged or bristly. *DISTRIB.* Species about 100; in both hemispheres, especially in the Old World.

Leaves 5-1 inch wide; corona nearly
equalling the corolla, campanulate,
toothed ...

1. *C. Dalhousiæ*.

Leaves 2-5 inches wide; corona much short-
er than the corolla, deeply 5-lobed ...

2. *C. auriculatum*.

1. *CYNANCHUM DALHOUSIÆ*, *Wight, Contrib.* (1834) p. 55.—An extensive twiner more or less woody below, stems slender with a line of hairs running down the internodes. Leaves 3-5 by 5-1 inch, oblong-lanceolate, deeply cordate with short rounded basal lobes and open sinus, narrowed to a long point, minutely pubescent on both sides, pale beneath, when dry the lower surface marked with minute raised dots, lateral nerves distant very oblique; petiole 5 inch long. Flowers 3 inch across, pale-green, in pedunculate, umbelliform cymes arising singly at the nodes from a little to the side of the leaf-axil. Peduncle about 3 inch long, puberulous; pedicels slightly longer, puberulous; bracts minute, linear. Calyx one-third the length of the corolla; lobes ovate, acute, puberulous. Corolla 2 inch long, divided nearly to the base, glabrous; lobes oblong, ultimately reflexed. Corona campanulate, 5-10-toothed, with 5 small scales near the base within, nearly as long as the corolla. Stigma not exerted. Follicles 4 by 6 inch, turgid, rather thin, smooth, pointed, widely divergent. Seed 3 inch long, oval, pale-brown, compressed, with a broad marginal wing; coma nearly 1.5 inches long. *Collett, Fl. Siml., fig. 98.*

Himalaya 4-8,000 feet from the Indus eastwards. Flowers : July—August. Common near Abbottabad. Chamba, Simla.

2. *CYNANCHUM AURICULATUM*, *Royle, ex Wight, Contrib.* (1834) p. 58.—An extensive twiner more or less woody, stems hollow with a band of hairs running down the internodes. Leaves 3-6 by 2-5 inches, broadly ovate or ovate-lanceolate, base deeply cordate with broad rounded lobes which sometimes meet or overlap, apex caudate-acuminate, margin often undulate, sparsely pubescent with short adpressed hairs above, puberulous on the nerves beneath, dark green above, paler or glaucous beneath, a few small conical glands at the base of the midrib above, basal nerves 5-7; petiole 1-3 inches long. Flowers .3-.5 inch across, yellowish-green, in many-flowered, long-peduncled cymes, arising singly at the nodes from a little to the side of the leaf-axil. Peduncle 2-6 inches long, stout, puberulous; pedicels .5 inch long, slender, puberulous; bracts variable, minute to .3 inch long. Calyx one-third the length of the corolla, lobes ovate, ciliate. Corolla .25 inch long, divided nearly to the base; lobes broad below narrowed upwards, pubescent within. Corona much shorter than the corolla, cup-shaped, deeply 5-lobed, lobes oblong, obtuse, bearing 5 small scales on their inner faces. Style-apex conical, two-lobed, slightly exserted beyond the stamens. Follicles 3-4 by .4-.5 inch, divaricate, turgid, firm, smooth, pointed. Seeds .35 inch long, narrow-oval, dull-brown, compressed, narrowly margined; coma 1 inch long.

Himalaya 6-8,000 feet from the Indus eastwards, not uncommon. Flowers : July—August.

In addition to the species described the following herbaceous members of the genus are found usually growing in rocky places :—

A. Erect perennials with annual woody shoots:

CYNANCHUM VINCEETOXICUM, *Pers.*—Stems 6-18 inches long. Leaves shortly petiolate, ovate, 2 by 1.5 inches. Flowers .2 inch across, yellow, in sessile or pedunculate cymes. Corolla-segments glabrous or nearly so. Corona 5-lobed, without internal processes, very variable; lobes triangular, oblong or rounded. Follicles usually solitary, 2.5-3 by .3-.4 inch, smooth, straight, long-pointed.

Himalaya 7-11,000 feet. Common.

CYNANCHUM GLAUCUM, *Wall.*—Similar to the above but more glabrous, pale or glaucous. Leaves narrower. Corolla segment bearded within.

Himalaya 5-9,000 feet from the Sutlej eastwards. Common.

CYNANCHUM ARNOTTIANUM, *Wight.*—Very similar to *C. glaucum*, but with dark-purple flowers.

Himalaya 4,500-8,000 feet. Fairly common in the Kagan and Siran valleys of Hazara, less common further east.

B. Sub-erect or twining perennials with woody rootstock and more or less herbaceous shoots.

CYNANCHUM ROYLEI, *Wight*.—A foot or so high, softly pubescent. Leaves 1-1.5 inches long, ovate, base deeply cordate with rounded auricles, apex long-acuminate; petiole .3-6 inch long. Flowers .3-5 inch across, numerous, in long-peduncled corymbose cymes, peduncle 1.5-3 inches long. Corolla pubescent within and without. Corona short, 5-lobed, lobes rounded with a tubercle on their inner faces. Follicles 2 inches long, fusiform, turgid, puberulous.

Kunawar.

CYNANCHUM JACQUEMONTIANUM, *Dene*.—Habit of *C. Roylei*, but nearly glabrous. Leaves 1-2 inches long, lanceolate from a broad deltoid or shallow cordate base, long-acuminate; petiole .3-5 inch long. Flowers .2-4 inch across, numerous, in long-peduncled, corymbose cymes; peduncle 1.5-3 inches long. Corolla glabrous without pubescent within. Corona equalling the corolla, 5-cleft, lobes subulate-lanceolate, entire or cleft with a flat process below them.

Kagan 7-9,000 feet.

10. *MARSDENIA*, R. Br.

(In honor of W. Marsden, a traveller and botanist of the 18th century. *DISTRIB.* Species about 70; tropical and sub-tropical regions of the world, 1 in S. E. Europe.)

MARSDENIA ROYLEI, *Wight, Contrib.* (1834) p. 40.—A softly pubescent or tomentose twining shrub, branches woody, rough with raised lenticels, twigs pubescent or tomentose. Leaves opposite, 3-5 by 1.5-3 inches, ovate, base cordate, sometimes truncate, apex acuminate, margins undulate, tomentose on the nerves and finely pubescent on the surface above, softly pubescent or tomentose beneath, basal nerves 3-5; petiole 1.5-2 inches long, stout, tomentose. Flowers .2 inch across, orange, in compact, many-flowered, compound cymes, arising singly at the nodes from a little to the side of the leaf-axils. Peduncle about 1 inch long, rather stout, tomentose; pedicels .1-1.2 inch long, tomentose; bracts minute. Calyx tomentose, half as long as the corolla, lobes ovate or lanceolate. Corolla campanulate, nearly .2 inch long, divided more than half-way down; lobes oblong, overlapping slightly to the right in bud, pubescent without, villous within. Corona of 5 slender, subulate processes, adnate to the base of the staminal-column, tips free, erect, converging, much exceeding the anthers. Staminal-column short, anthers with inflexed tips, pollen-masses solitary in each cell, erect, waxy. Stigma convex. Follicles 3 by 1 inch, solitary, straight, beaked, hairy, pericarp thick, deeply wrinkled. Seeds .4 inch long, brown, narrowly winged; coma 1 inch long. Collett, *Fl. Siml.*, fig. 99.

Himalaya 3-7,000 feet from the Indus eastwards usually on rather open hillsides. Flowers: June—August. The stem contains a strong fibre.

11. DREGÆA, E. Mey.

(In honor of Johann Franz Drege, a German botanical traveller at the Cape, 1794-1881. Species 9; from Africa, Tropical and Southern, to China).

DREGÆA VOLUBILIS, *Benth. Gen. Pl.* II (1876) p. 775.—A large twining shrub, glabrous or hoary, branches rough with raised lenticels. Leaves opposite, 2·5-6 by 1·7-4·5 inches, broadly ovate or suborbicular, base cuneate, rounded or cordate, apex abruptly short-acuminate, pubescent especially beneath when young, glabrous when mature, lateral nerves crowded in the lower part of the leaf distant in the upper, a few small glands at the base of the midrib above; petiole stout, ·5-1·8 inches long. Flowers ·4 inch across, green or yellowish-green, in drooping, umbellate cymes, arising singly at the nodes from the side of the leaf-axils. Peduncle 1-2 inches long, puberulous; pedicels ·5-1·5 inches long, rather slender, puberulous; bracts ·8 inch long, lanceolate, blunt, early deciduous. Calyx divided nearly to the base; lobes ·1 inch long, ovate, pubescent outside, ciliate. Corolla ·25 inch long, cup-shaped, rather thick, pubescent outside, divided more than half-way down; lobes broad-ovate-obtuse, overlapping to the right in bud. Corona of 5 fleshy processes adnate below to the staminal column, upper portion of each process free, rounded on the back and obliquely truncate at the apex, bearing a small cuspidate point on the inner edge which projects against the top of the anther. Filaments united, anthers with small membranous inflexed tips; pollen-masses solitary in each cell, erect, waxy. Stigma dome-shaped, slightly exceeding the anther-tips. Follicles usually solitary, 3-4 by ·7 inch, slightly tapering to a blunt point, longitudinally ribbed or winged. Seeds ·5 inch long, broadly ovate, compressed, with a wide margin; coma 1·5 inches long. *Marsdenia volubilis*, T. Cooke, *Fl. Bomb.* II, p. 166. Duthie *Fl. Upper Gang.* Plain II, p. 56.

Lower Himalaya ascending to 5,000 feet. Sub-Himalayan tract from the Ravi eastwards. Delhi. Flowers: April—June.

12. PERGULARIA, Linn.

(From the Latin *pergula*, an arbor; referring to the twining habit. **DISTRIB.** Species 10; Asia and Africa.)

(This genus is sometimes called *Telosma*, Coville, *Pergularia* being substituted for the generic name *Damia*, R. Br.,—*vide* N. E. Brown "The Genus *Pergularia*" in *Kew Bulletin*, 1907, p. 323).

PERGULARIA PALLIDA, *Wight et Arn. Contrib.* (1834) p. 42.—A pubescent or nearly glabrous twining shrub, juice milky. Leaves opposite, 2-4 inches long, ovate, base cordate usually deeply, apex acuminate, more or less puberulous especially on the nerves or glabrous, a few minute conical glands at the

base of the midrib above, lower surface pale; petiole .5-1.5 inches long, usually twisted at the base. Flowers pale-yellowish, .7 inch across, not or faintly scented, in umbellate cymes arising singly at the nodes from the side of the leaf-axils. Peduncles .2-.6 inch long, pubescent; pedicels .5 inch long, pubescent; bracts .15 inch long, linear, caducous. Calyx divided to the base, sepals .2 inch long, oblong, hairy without, ciliate, alternating with small solitary glands. Corolla .7 inch long, salver-shaped, tube swollen at the base, slightly hairy near the base within; lobes twice as long as the tube, linear-oblong, glabrous, overlapping to the right in bud. Corona of 5 erect, membranous, dorsally flattened processes arising from the base of and adnate to the staminal column, each with a tongue-like prolongation from the inner face which exceeds the stigma. Filaments united, anthers with long, membranous, pointed appendages; pollen-masses solitary in each cell, cylindric, erect, waxy. Stigma large, umbonate, slightly exceeding the anther-tips. Follicles solitary, 2.5-4 by .7 inch, straight, smooth, turgid, tapering to a blunt point. Seed .4 inch long, pale-brown, flat, broadly margined; coma 1 inch long. *Telosma pallida*, comb. nov.

Lower Himalaya ascending to 5,000 feet and adjacent plains from the Indus eastwards. Flowers: July–August. Common in Phillaur plantation.

13. HOYA, R. Br.

(In honor of Thomas Hoy, at one time gardener to the Duke of Northumberland at Sion House near Kew. DISTRIB. Species 60-70; Tropical Asia and Australia.)

HOYA LONGIFOLIA, Wall. in Wight, *Contrib.* (1834) p. 36.—A glabrous fleshy shrub, climbing by means of adventitious roots. Leaves opposite, 2-5 by .5-1 inch, narrow-lanceolate or oblanceolate, acuminate, dull-green, thick and fleshy, nerves very obscure; petiole .3-.5 inch long, stout. Flowers waxy, white tinged with pink, .6-.8 inch across, in axillary, umbellate cymes. Peduncle stout, .5-2 inches long, glabrous; pedicels .5-1 inch long; bracts minute. Calyx 5-partite; lobes .05 inch long, ovate, alternating with solitary glands. Corolla rotate, thick, fleshy, cleft half-way down; lobes as broad as long, subtriangular, glabrous or pubescent within, margins pubescent, valvate in bud. Corona of 5 fleshy processes adnate to the base of the staminal column, stellately spreading, inner angle of each process produced into a spur incumbent on the anther, back convex below with the margins incurved, tips rounded on the outer side. Staminal-column short, filaments united, anthers with broad membranous tips, conniving over the stigma, pollen-masses solitary in each cell, waxy, erect. Stigma included, flat, with an apiculate centre. Follicles solitary,

8-12 inches long, stalked, very slender, thin, smooth. Seeds minute .05 inch long, ovoid, tuberculate; coma .5 inch long of 2-3 hairs at the top and a solitary hair at the base.

Himalaya 1-4500 feet from the Sutlej eastwards. On damp mossy rocks below Chota Simla and at low elevations in Bashahr, not common. Flowers: July—August.

14. LEPTADENIA, R. Br.

(From the Greek *leptos*, slender, and *aden*, a gland; referring to the pellucid tips of the pollen-masses).

Erect nearly leafless shrubs or twining leafy shrubs. Leaves opposite. Flowers small, in crowded cymes solitary at the nodes. Calyx turbinate, small, 5-lobed, lobes ovate. Corolla rotate or shortly campanulate with hairy valvate lobes. Corona double, the outer corolline of 5 scales beneath the sinuses, the inner staminal of a raised undulate fleshy ring at the base of the staminal-column. Staminal-column short, filaments united, anthers incumbent on the stigma, without terminal appendages; pollen-masses solitary in each cell, globose, erect, waxy with pellucid tips. Follicles smooth. **DISTRIB.** Species about 12; tropical Asia and Africa.

Erect, nearly leafless	...	...	1. <i>L. Spartium</i> .
Twining, leafy	...	...	2. <i>L. reticulata</i> .

1. *LEPTADENIA SPARTIUM*, *Wight, Contrib.* (1834) p. 48.—An erect twiggy nearly leafless shrub, 6-8 feet high, twigs dull-green, hoary when young, less than .1 inch diameter, flexible. Leaves 1-2 by .1-.15 inch, linear, sometimes smaller, usually wanting, subsessile. Flowers yellow, .1 inch long, in small umbellate cymes. Peduncle .1-.3 inch long, hoary; pedicels .1 inch long, hoary. Calyx .05 inch long, cleft half-way down, pubescent, lobes ovate-deltoid. Corolla funnel-shaped, glabrous below; lobes ovate-oblong, pubescent within and without, thickened and keeled towards the tips. Corona; coralline of minute scales below the sinuses, rounded on the top and pubescent; staminal a minute lobed ring near the base of the staminal-column. Staminal-column very small. Follicles solitary, reflexed, 3-4.5 by .25 inch, straight, smooth, pericarp thin. Seeds .3 inch long, narrow-lanceolate; coma 1-1.5 inches long. **Vern.** *Khip* (Plains).

Punjab plains on sandy soils; Hoshiarpur *Chos*, Delhi, S. E. Punjab, Multan. A characteristic plant of dry sandy desert tracts abundant in Jaipur State, Sind and Baluchistan. Flowers: October—January. Yields a fibre used for ropes. The plant is likely to be mistaken for *Orthanthera viminea* (q. v.). According to Mr. L. B. Holland this plant is plentiful along the whole length of the Hoshiarpur Siwaliks extending about 2 miles into the plains. It appears to have spread very considerably in this tract during the past few years. The juice is clear and greenish, not milky except in the fruit.

2. *LEPTADENIA RETICULATA*, *Wight, & Arn. in Wight, Contrib.* (1834) p. 47.—A leafy twining shrub without milky juice, shoots hollow, hoary when young. Leaves 1·5-3 by ·5-2 inches, ovate or ovate-lanceolate, base truncate or rounded, sometimes cuneate, apex acute or short-acuminate, hoary on both sides especially beneath, glabrous and shining above when mature, coriaceous, base of midrib minutely glandular above; petiole ·3-1 inch long, puberulous. Flowers ·2-·3 inch across, greenish-yellow, in many-flowered, umbellate cymes, cymes often in pairs but both from the same leaf-axil. Peduncle ·3-·5 inch long, puberulous; pedicels ·2-·3 inch long, puberulous; bracts minute, deltoid. Calyx deeply divided, puberulous without; lobes ovate-oblong, subacute. Corolla ·2 inch long (twice as long as the calyx), tube funnel-shaped glabrous; lobes thick, spreading, slightly exceeding the tube, ovate-oblong, margins revolute and tips keeled within, puberulous within and without. Corona; coralline of 5 broad low fleshy processes beneath the sinuses; staminal, a minute undulate ring round the column beneath the anthers. Follicles sub-woody, 2·5-3·5 inches long, turgid, tapering to an obtuse, shortly curved beak. Seeds ·25 inch long, narrowly ovate-oblong, acute; coma 1·2-1·5 inches long.

From the foot of the Himalaya east of the Sutlej southwards* to Ceylon and eastwards to Burma. Flowers: June—September.

15. *ORTHANTHERA*, *Wight*.

(From the Greek *orthos*, erect, and *antheros*, flowering. *DISTRIB.* Species 4; India and South Africa.)

ORTHANTHERA VIMINEA, *Wight, Contrib.* (1834) p. 48.—An erect twiggy shrub, leafless or nearly so, 6-8 feet high, young shoots pubescent, older glabrous, green, flexible, less than ·1 inch diameter. Leaves when present, opposite, ·1 inch long, linear, pubescent. Flowers ·3 inch long, dull-brown, in compact few-flowered cymes arranged singly at the nodes. Peduncle ·1-1 inch long, pubescent, sometimes forked at the top; pedicels ·1 inch long, densely clothed with short, brown, silky hairs. Calyx ·2 inch long, divided nearly to the base; lobes linear-oblong, slightly exceeding the corolla-tube, densely hairy without, hairs short, silky, glabrous within except towards the tips. Corolla tubular below, much contracted at the base and adnate to the base of the staminal column, widened passed the anthers, villous without, glabrous within; lobes equalling the tube, spreading, valvate in bud, villous without glabrous within, oblong, keeled towards the tips, with small folds under the

sinuses. Corona small, of a ten-lobed ring below the anthers. Filaments united, anthers without membranous appendages, incumbent on the stigma. Stigma conical, included, 5-angled below the minute 2-lobed apex. Follicles solitary, erect, 3-4·5 by ·2 inch, straight, smooth, pericarp thin. Seed ·1-·15 inch long, dark-brown, flat, with a narrow paler margin; coma ·7 inch long.

The Flora of British India gives the distribution "from Peshawar and the Punjab to Oudh" and I suspect the plant has been confused with *Leptadenia Spartium* which is exceedingly similar but has smaller flowers and reflexed follicles. In both species as a rule only one follicle is produced from each cyme or cyme-branch, in *Orthanthera* the cymes are about 3-8 flowered and the scars of the fallen flowers are visible on the peduncle of the follicle all at about the same level whereas in *L. Spartium* the flowers are more numerous and the scars of the sterile flowers are visible forming a narrow belt on the fruiting peduncle which at this point is slightly swollen. The erect and reflexed positions of the follicles in the two species appear to be a reliable character. The folds under the sinuses of the corolla-lobes represent a corolline corona according to Benthams who unites the genus with *Leptadenia*. It occurs in beds of streams between the Jumna and Ganges flowering in February to May, but I have not seen specimens from the Punjab.

ASCLEPIAS CURASSAVICA, Linn.—An erect undershrub 3-4 feet high. Leaves opposite, 3-4 by ·5-1 inch, lanceolate, thin, membranous, narrowed at both ends; petiole ·2 inch long. Flowers ·3 inch across, orange, in axillary umbels; peduncle 1 inch long; pedicels ·7 inch long. Calyx ·1 inch long, cleft to the base, lobes oblong-lanceolate. Corolla ·25 inch long, lobes reflexed in flower, valvate in bud. Corona bright-orange, of 5 erect processes adnate to the stipe of the staminal-column. Staminal-column distinctly stipitate, anthers with membranous inflexed tips; pollen-masses solitary in each cell, pendulous, flattened, waxy. Follicles solitary, erect, 3 by ·3-4 inch, straight, tapering at both ends, pericarp thin. Seed ovoid, ·2 inch long, dark-brown; coma 1·2 inches long.

A native of the West Indies grown in gardens in the Punjab. Naturalized in many parts of India and likely to be met with as an escape in the moister parts of the Punjab. In flower most of the year.

LXI. LOGANIACEÆ.

Trees, shrubs or herbs. Leaves opposite, simple; stipules present or represented by a raised line joining the bases of the petioles. Flowers 4-5-merous, usually regular and bisexual, generally in 2-3-chotomous cymes. Calyx inferior, lobes usually equal and imbricate. Corolla gamopetalous, lobes imbricate, contorted or valvate. Stamens as many as and alternating with the corolla-lobes, inserted on the corolla-tube; anthers 2-celled. Disk wanting or inconspicuous. Ovary free, usually 2-celled; ovules 1-many in each cell; style usually simple; stigma clavate, capitate or 2-lobed. Fruit capsular, baccate or drupaceous. **DISTRIB.** A family mainly tropical and sub-tropical.

BUDDLEIA, Linn.

(In honor of the Rev. Adam Buddle, a British botanical author of the 18th century.)

Trees, shrubs or herbs, usually clothed with stellate or glandular hairs or scales. Leaves opposite, entire, crenate or toothed, stipules usually represented by a raised line uniting the petioles. Flowers 4-merous, in globular heads or cymes which are axillary or arranged in a thyrsoid terminal panicle. Calyx campanulate. Corolla-tube cylindric or campanulate; lobes short, broad, spreading, imbricate. Filaments short, anthers scarcely exserted or included in the corolla-tube. Ovary 2-celled; cells many-ovuled. Capsule septicidally 2-valved, valves 2-fid or entire. Seeds numerous, minute. **DISTRIB.** Species 70; Asia, America and South Africa.

Leaves on vigorous shoots, oblong or ovate,
coarsely sinuate-dentate; flowers blue ... 1. *B. paniculata*.

Leaves lanceolate, entire or serrulate; flowers
white ... 2. *B. asiatica*.

1. **BUDDLEIA PANICULATA**, Wall. *Cat.* (1828) No. 6403.—A shrub with gnarled stem, bark peeling off in long shreds, twigs, leaves beneath, inflorescence, bracts and calyx clothed with soft white tomentum. Leaves very variable, on sterile shoots 3-5 by 1.5-2 inches, ovate or oblong, base cordate or hastate, margins coarsely sinuate-dentate, the upper leaves and those on flowering shoots often much smaller, usually entire or nearly so with cuneate or rounded bases; all thick, with depressed nerves above, clothed on the upper surface with deciduous tomentum, densely white tomentose beneath; petioles up to 1 inch long, stout, tomentose. Flowers .4 inch long, lavender-blue, rarely white or pink, fragrant, in short dense spikes arranged in a leafy interrupted terminal panicle. Calyx .15 inch long, campanulate; lobes short, blunt. Corolla-tube tomentose without, throat orange, limb .3-.4 inch across; lobes broad, sinuate or crenulate. Anthers included. Style long or short. Capsule .2-.25 inch long, tomentose, ellipsoid. *B. crispa*, Benth. Collett, *Fl. Siml.*, fig. 100.

Himalaya 2,500—8,000 feet. Common in rather hot dry places. Trans-Indus to Sikkim. Extends to Kunawar and Kagan. Flowers: April—May. In most floras the tomentum is described as tawny, a color it assumes in the herbarium, on the living plant the tomentum is white.

2. **BUDDLEIA ASIATICA**, Lour. *Fl. Cochinch.* (1790) p. 72.—A large evergreen shrub, twigs, leaves beneath, inflorescence, bracts and calyx clothed with a dense grey felt of stellate hairs. Leaves 2.5-5 by .4-1.2 inches, lanceolate, acute or acuminate, entire or serrulate, usually glabrous above, base narrowed;

petioles 0·4 inch long. Flowers ·25·3 inch long, white, fragrant, in dense terminal and axillary solitary or paniced, usually continuous spikes. Calyx ·15 inch long, campanulate, cleft : early half-way down, lobes subacute. Corolla-tube tomentose without and in the throat, limb ·2 inch across, lobes obovate, blunt. Anthers included. Capsule ·2·25 inch long, glabrous, ellipsoid. *B. Neemda*, Ham.

Sub-Himalayan tract and outer Himalaya from the Indus eastwards. Fairly common. Flowers : February—April. Often grown in gardens in the plains.

BUDDLEIA MADAGASCARIENSIS, Lamk.—A large rambling evergreen shrub. Leaves about 4 by 1·5 inches, oblong, entire, thick, dark-green glabrescent with depressed nerves above, densely white-tomentose beneath. Flowers ·4 inch long, yellow, in large terminal panicles.

A native of Madagascar and the Mascarenes. Often grown in gardens in the plains. Flowers : March.

BUDDLEIA LINDLEYANA, Fort.—An erect shrub. Leaves about 2 by ·8 inch, entire or faintly dentate, thin, glabrescent above, minutely tomentose beneath. Flowers ·6 inch long, blue, in long drooping terminal spikes. Corolla-tube curved.

A native of China. Cultivated in gardens in the plains and hills. Flowers : July—October.

NICODEMIA DIVERSIFOLIA, Tenore.—A plant from Madagascar, occasionally grown in gardens in the plains. Leaves about 1·5-2 inches long, mostly coarsely sinuate, nearly glabrous. Fruit a berry. Flowers greenish, November.

LXII. BORAGINACEÆ.

Herbs, usually rough and bristly-hairy, rarely shrubs or trees. Leaves alternate, very rarely opposite, stipules 0. Flowers usually in dichotomous scorpioid cymes, rarely solitary and axillary, 5-, rarely 4-merous, regular, rarely zygomorphic. Calyx inferior, usually persistent in fruit. Corolla gamopetalous, often with scales in the throat, 4-5-, rarely 6- or more-lobed, usually imbricate. Stamens inserted on the corolla-tube, as many as and alternatng with the corolla-lobes. Ovary superior; cells 2, two-ovuled or 4 one-ovuled; style terminal or from between the ovary-lobes; ovules suberect from the inner basal angle of the cell. Fruit drupaceous or dividing into 2-4 nutlets. **DISTRIB.** A large family of temperate or tropical regions but of comparatively little forest importance.

Trees or shrubs.

Leaves 3-5-nerved or 1-nerved and subopposite;
style twice forked; calyx shortly lobed ... 1. *Cordia*.

Leaves 1-nerved, alternate; style bifid; calyx
deeply lobed ... 2. *Ehretia*.

An undershrub ... 3. *Sericostoma*.

1. *CORDIA*, Linn.

(In honor of E. Cordus, a German physician and writer on medicinal plants in the 16th century.)

Trees or shrubs. Leaves alternate, rarely opposite or subopposite, entire or toothed, petiolate. Flowers polygamous (male and bisexual), usually white or yellow, in cymes, spikes or heads. Calyx tubular or campanulate, smooth or ribbed, teeth 3-5, short, often irregular or obscure. Corolla funnel-shaped or campanulate; lobes 4-8, spreading or reflexed. Stamens as many as the corolla-lobes, inserted in the corolla-tube; filaments often hairy at the base; anthers shortly exerted. Ovary 4-celled; style terminal, elongate, bipartite the branches again bipartite; stigma capitate or clavate; ovules solitary in each cell. Fruit drupaceous, ovoid or elliptic, supported by the persistent calyx; stone bony, usually 1-seeded by abortion. **DISTRIB.** Species about 250; tropical, mainly American.

Leaves alternate (rarely subopposite in *C. Macleodii*), usually 3-5-nerved.

Calyx not ribbed, glabrous externally ... 1. *C. Myxa*.

Calyx ribbed, pubescent or tomentose externally.

Leaves cordate or rounded at the base; corolla-tube glabrous within ... 2. *C. Macleodii*.

Leaves cuneate or rounded at the base; corolla-tube very hairy within ... 3. *C. vestita*.

Leaves subopposite, 1-nerved ... 4. *C. Rothii*.

1. *CORDIA MYXA*, Linn. *Sp. Pl.* (1753) p. 190.—A medium-sized deciduous tree, bark with numerous shallow longitudinal fissures, branchlets glabrous or more or less brown-tomentose when young. Leaves alternate, 3-5 by 2·5-4·5 inches, variable, orbicular, broadly ovate, ovate-elliptic, or obovate, obtuse or more or less abruptly acuminate, base rounded or cuneate, margin entire or more or less sinuate-dentate, glabrous or nearly so above, but rather harsh without white disks (*cystoliths*) more or less pubescent especially in the axils of the nerves beneath, basal nerves 3 rarely 5; petiole 7-1·5 inches long. Flowers 2-4 inch across, white, polygamous, in large, lax, terminal and axillary, pedunculate cymes; peduncle 1-2 inches long; pedicels short; buds pyriform. Calyx about 2 inch long, glabrous without, pubescent within, splitting irregularly on the opening of the flower. Corolla-tube as long as the calyx; lobes 5, as long as the tube, oblong, obtuse, recurved. Filaments hairy at the base. Drupe ovoid, 5-1 inch long, apiculate, yellowish-brown, pink or nearly black when ripe, shining, minutely rugose, supported by the saucer-shaped faintly striate calyx, pulp nearly transparent, viscid, sweetish, edible. *C. obliqua*, Willd. Vern *Lasura*.

Sub-Himalayan tract and outer ranges ascending to 5,000 feet from the Rawalpindi District eastwards. Salt Range. Often cultivated by natives. Wood greyish-brown, moderately hard, not durable. Growth fairly fast. Flowers: March—April.

I have followed Brandis, Cooke and Duthie in uniting *C. obliqua*, Willd. and *C. Myxa*, though Haines, Forest Flora of Chota Nagpur, keeps them separate. Both Brandis (Indian Trees) and Cooke (Fl. Bomb.) maintain *C. Wallichii*, G. Don. (= *C. obliqua* var. *Wallichii*, C. B. Clarke in Fl. Br. Ind., IV, p. 137.) as a species distinct from *C. Myxa*. The Fl. Br. Ind. gives the distribution "from Lahore to Kurg." I have seen no Punjab specimens and no species of *Cordia* is indigenous near Lahore. *C. Wallichii* differs from *C. Myxa* in the leaves being densely clothed beneath with fulvous or white tomentum. (See also Haines' remarks on *Cordia* in Ind. Forester XL. July 1914, p. 347—348.)

2. *CORDIA MACLEODII*, Hook. f. & Thoms. in Journ. Linn. Soc. II (1858) p. 128.—A small tree with smooth grey bark, twigs clothed with dense white pubescence or (tawny?) tomentose. Leaves alternate or sometimes almost subopposite, 3-7 by 2-2-6 inches, orbicular or broadly ovate, obtuse, base cordate or rounded, margins sinuate, firm and hard when mature, glabrous above with impressed nerves and raised disks (*cystoliths*), clothed beneath with dense short or matted, grey (or tawny?) tomentum, basal nerves usually 3-5 or the nerves sub-basal or sometimes the lowest pair of secondary nerves arising at some distance from the base; petiole 1-2 inches long, stout, tomentose. Flowers white, .5 inch across, subsessile, polygamous, in dense terminal and axillary paniculate tomentose cymes; buds obovoid. Calyx .3-.4 inch long, thick, ribbed, densely tomentose without, glabrous within. Corolla-tube equalling the calyx, glabrous within, lobes usually 6, as long as or longer than the tube, spreading, spatulate-oblong, obtuse, veined. Filaments hairy at the base. Drupe .5-.7 inch long, ovoid, acute, supported by the cup-shaped, slightly ribbed calyx.

Said to occur in Kangra and Rawalpindi Districts but I have never seen it and there are no Punjab specimens in Dehra, Calcutta or at the Indian Museum. The fruit is not edible. The timber is hard and tough and useful for furniture, carts, etc. The tree grows well in dry localities and would be worth experimental cultivation for timber. Flowers: April—May.

3. *CORDIA VESTITA*, Hook. f. & Thoms. in Journ. Linn. Soc. II (1858) p. 128.—A small deciduous tree, bark greenish-grey, exfoliating in large woody flakes, branchlets densely grey-tomentose when young. Leaves alternate, 3-6 by 2-5-5 inches, sometimes larger, orbicular, broadly ovate or obovate, apex rounded or acuminate, base rounded or cuneate near the petiole, margins undulate, scabrous above with rather prominent white disks (*cystoliths*), tomentose beneath until mature, basal nerves 3-5, arising usually from a little above the base; petiole 1-1.5

inches long, stout. Flowers $\cdot 5$ inch across, yellowish-white, polygamous, in dense compound cymes; male in unilateral racemes; peduncle and pedicels tomentose; buds pyriform. Calyx $\cdot 4$ inch long, pubescent and more or less ribbed without, slightly hairy near the base within, lobes 5. Corolla-tube equalling the calyx, very hairy within; lobes 5, slightly shorter than the tube, spreading, obovate, crenulate, notched at the tip. Filaments hairy at the base. Drupe $\cdot 7$ inch long, ellipsoid, acute, supported by the accrescent calyx which is campanulate, $\cdot 5$ inch long, thick and strongly ribbed; pulp gelatinous, edible. Vern. *kumbhi*.

Salt Range and Sub-Himalayan tract from the Jhelum eastwards, not common. Flowers: April—May. This tree is best recognised by the color of the bark, which is smooth except in old specimens.

4. *CORDIA ROTHII*, Roem. & Schult. Syst. IV (1819) p. 798.—A large shrub or small tree, twigs glabrous or nearly so. Leaves nearly or quite opposite, 2-4 by $\cdot 7$ -1 inch, oblanceolate-oblong, entire, apex rounded, rough and glabrous above when mature, more or less pubescent beneath, 1-nerved at the tapering base; petioles $\cdot 3$ - $\cdot 5$ inch long. Flowers $\cdot 2$ inch across, white, usually tetramerous, in lax terminal or axillary pedunculate cymes. Peduncles $\cdot 5$ -1 inch long, puberulous; pedicels short, slender. Calyx $\cdot 2$ inch long; minutely pubescent without, silky within; lobes small, obtuse. Corolla $\cdot 25$ inch long; lobes equalling the tube, oblong, obtuse, reflexed. Filaments glabrous. Drupe usually 1-seeded, about $\cdot 5$ inch long, ovoid, mucronate, striate, yellow or reddish-brown when ripe, with gelatinous edible pulp. Brandis, Ind. Trees, fig. 172. Vern. *Gondi*.

Dry parts of the Punjab. Flowers: April to June. Often grown in native gardens in the plains. It is wild in Jaipur State; on the Delhi Ridge and probably also in the hills in the S.-E. Punjab. Gamble remarks "The wood is a fine one and deserves to be better known, and the tree to be more propagated." It would be worth trying in the Pabbi as it grows in very dry places, but is hardly large enough for timber.

2. *EHRETIA*, Linn.

(In honor of G. D. Ehret, a German botanical artist of the 18th century and brother-in-law of Philip Miller.)

Trees or shrubs. Leaves alternate. Flowers small, usually white, in terminal and axillary corymbose cymes or panicles, rarely solitary. Calyx small, 5-partite. Corolla-tube short, lobes 5, spreading, imbricate. Stamens 5, inserted on the corolla-tube, usually exserted. Ovary 4-celled or 2-celled, each cell in the latter case being incompletely divided; ovules 4; style terminal, 2-fid or 2-partite; stigma capitate or clavate. Fruit a drupe, small, subglobose, 4-seeded or fewer by abortion, endocarp hard consisting of one 4-celled or two 2-celled or four 1-celled pyrenes (3-1 pyrenes or cells sometimes suppressed).

DISTRIB. Species about 40 ; warmer parts of both hemispheres but mainly in the Old World.

- | | |
|--|------------------------------|
| Leaves serrate | ... 1. <i>E. acuminata</i> . |
| Leaves entire. | |
| Leaves not exceeding 3 inches long, hairy beneath when mature, a shrub | ... 2. <i>E. aspera</i> . |
| Leaves usually larger, glabrous beneath when mature, a small tree | ... 3. <i>E. laevis</i> . |

1. *EHRETIA ACUMINATA*, *R. Br. Prodr.* (1810) p. 497.—A medium-sized deciduous tree with rough not deeply fissured grey bark, twigs pubescent when quite young. Leaves 3-7 by 1·2-2·5 inches, usually elliptic-oblong, acuminate, serrate, teeth small, rather close, blunt with the tips often incurved, base narrowed rarely rounded, midrib sparsely adpressed-hairy above and nerves slightly hairy in the axils beneath otherwise glabrous ; petiole ·5-1·2 inches long. Flowers ·2 inch across, white, fragrant, sessile, in large terminal puberulous panicles, the lower branches axillary. Calyx ·1 inch long ; lobes rounded, ciliate. Corolla twice as long as the calyx ; lobes blunt, spreading. Style shortly bifid ; stigmas small, capitate. Drupe ·15 inch diameter, globose, nearly black when ripe ; pyrenes 2, each 2-celled, cells 1-seeded. *E. serrata*, Roxb. Vern. *puna*.

Himalaya ascending to 5,000 feet and Sub-Himalayan tract from the Indus eastwards. Commonly cultivated by villagers in Hazara and lopped for fodder. It is a handsome tree especially when in flower and is grown in gardens in the plains. An excellent road-side tree in the Sub-Himalayan tract though not often grown as such. Rare in the Simla District but has been collected in Bashahr. Wood very light brown, moderately hard, easily worked. In Lahore it flowers in March-April, in the hills usually in May but sometimes in November.

2. *EHRETIA ASPERA*, *Roxb. Cor. Pl.* I (1795) p. 41, t. 55.—A deciduous shrub, young twigs clothed with brown pubescence and grey spreading hairs. Leaves 1-2·5 by ·7-1·5 inches, rarely 3 by 2 inches, variable, usually obovate and rounded or retuse at the apex, clothed on both sides but especially above with adpressed grey hairs, when old scabrid above, persistently hairy beneath, entire ; petiole ·2-·7 inch long. Flowers ·3-·5 inch across, pale bluish-white, in paniculate cymes which are at first close, corymbose and apparently terminal, afterwards lax and lateral. Calyx ·1 inch long, hairy without ; lobes ovate-oblong, acute or subacute, ciliate. Corolla ·25-·3 inch long, tube exceeding the calyx ; lobes about as long as the tube, blunt, spreading. Style shortly bifid ; stigmas capitate. Drupe ·25 inch across, depressed-globose, pyrenes usually 4. *E. obtusifolia*, Hochst. *E. laevis* var. *aspera*, C. B. Clarke in *Fl. Brit. Ind.* I. V, p. 142.

Dry places in the Sub-Himalayan tract. Salt Range. Pabbi Hills, Changa Manga, &c. Flowers : March—May. A much smaller plant than *E. laevis* with smaller leaves, always hairy beneath and rather larger flowers.

3. *EHRETIA LÆVIS*, *Roxb. Cor. Pl.* I (1795) p. 42, t. 56.—A small deciduous tree or large shrub, bark smooth, grey, twigs glabrous or nearly so. Leaves 3-5 by 2-3·5 inches, very variable, usually broadly elliptic or elliptic-obovate, apex rounded or acuminate, sometimes retuse, glabrous or nearly so when mature, bright glossy green above, paler beneath, entire, thin, membranous; petiole ·4-·8 inch long. Flowers ·3 inch across, white, in much-branched corymbose axillary and terminal cymes composed of unilateral spikes, appearing before or with the young leaves. Calyx less than ·1 inch long, hairy without; lobes ovate, subacute. Corolla ·2 inch long, tube exceeding the calyx; lobes exceeding the tube, blunt, spreading. Style stout, more or less bifid; stigmas capitate. Drupe ·2 inch across, depressed-globose, somewhat 4-lobed, red when ripe, with 1-4 one-seeded pyrenes. Vern. *Sakar* (Rp.), *chamror* (Ka. &c.).

Sub-Himalayan tract from the Indus eastwards, very common. Locally in the plains in the moister districts. Flowers: March–April. Abundant in the Phillaur plantation where it comes up under the shelter of the other trees. Spreads readily by root-suckers. The wood is tough and fairly durable but is little used. The tree is too crooked to yield much timber.

EHRETIA BUXIFOLIA, *Roxb.*—A small evergreen shrub. Leaves crowded on dwarf shoots, ·5-1 inch long, cuneate-obovate, tip usually with a few coarse crenate teeth, rough on both sides with scattered short bristly hairs, polished above, subsessile. Flowers ·3 inch across, solitary or twin, white. Styles 2, or 1 divided nearly to the base, long, slender. Drupe ·3 inch across, depressed-globose, sub-4-lobed, scarlet, pyrene 1, four-celled.

Native of Ceylon, Malaya and China. Grown in gardens in the plains.

3. *SERICOSTOMA*, Stocks.

(From the Greek *serikos*, silky, and *stoma*, mouth; referring to the hairs closing to the mouth of the corolla-tube. *DISTRIB.* Species 3; Arabia to India.)

SERICOSTOMA PAUCIFLORUM, *Stocks, in Wight, Icon.* (1850) t. 1377.—A small straggling undershrub 6-18 inches high; stems woody below, scabrid upwards with short adpressed hairs. Leaves variable, ·1-·5 inch long, occasionally longer, linear-lanceolate, subobtuse, concave, clothed on both sides but especially beneath with short rigid bulbous-based adpressed hairs. Flowers ·15 inch across, white, sessile, solitary, axillary or in a short bracteate raceme. Calyx ·15 inch long, densely clothed with short rigid adpressed hairs like the stem and leaves; lobes 5, the two outer larger than the others, ·1 inch long, lanceolate, acute, somewhat enlarged in fruit. Corolla-tube as long as the calyx, broad, somewhat funnel-shaped, densely hairy within and at the base of the lobes, hairs silky, radiating towards the centre and closing the mouth, lobes spreading, imbricate. Stamens 5, subincluded, inserted at the sinuses of the corolla; filaments very short; anthers oblong. Ovary deeply 4-lobed;

style short, slender; stigma capitate. Nutlets .1 inch long, ovoid, sub-stipitate, keeled or angled on the ventral face, rounded and angular on the back, style-scar basal, included in the persistent closed calyx.

Plains of the S.-E. Punjab. Hissar. Abundant in Jaipur State and characteristic of sandy soils. Flowers: December—February.

LXIII. CONVOLVULACEÆ.

Herbs, undershrubs or shrubs, rarely trees, often twining to the left. Leaves alternate, often palmately lobed (wanting in *Cuscuta*), exstipulate. Flowers regular, usually bisexual, often showy. Calyx free, often persistent; sepals 5, free or united usually only near the base. Corolla campanulate, funnel-shaped or rotate, often plicate in bud; limb 5-lobed or -angled, rarely deeply divided. Stamens 5, inserted in the corolla-tube opposite the sepals, anthers often twisted. Disk intrastaminal, annular, sometimes almost obsolete. Ovary superior, 1-4-celled, usually of 2 carpels; ovules usually 2 in each carpel; styles 1-2; stigma capitate, 2-lobed or stigmas 2. Fruit capsular, 2-4-valved, circumsciss, or breaking up irregularly or indehiscent. **DISTRIB.** A family of little forest importance but containing many showy garden plants, more abundant in the warmer parts of the world.

Erect shrubs or undershrubs.

- | | | |
|---|-----|----------------------|
| Corolla-lobes imbricate; stamens exserted | ... | 1. <i>Cressa</i> . |
| Corolla plicate; stamens included | ... | 2. <i>Breweria</i> . |

Twining shrubs.

- | | | |
|---|-----|-----------------------|
| Flowers small, very numerous, in panicles | ... | 3. <i>Porana</i> . |
| Flowers large, solitary or few together. | | |
| Leaves glabrous above, silky beneath; flowers white | ... | 4. <i>Rivea</i> . |
| Leaves stigose on both sides; flowers rose-purple | ... | 5. <i>Lettsonia</i> . |

1. *CRESSA*, Linn.

(From the Greek *cressus*, appertaining to the island of Crete. **DISTRIB.** Species 3; warmer regions of the world.)

CRESSA CRETICA, Linn. *Sp. Pl.* (1753) p. 223.—A dwarf erect greyish shrub 6-15 inches high; stems slender, much branched, hairy, internodes very short. Leaves numerous, subsessile, .1-.2 inch long, ovate, acute, densely silky-hairy. Flowers very small, white or pink, sessile, in small clusters in the axils of the upper leaves; bracts 2, linear, .1 inch long, hairy, adpressed to the calyx. Calyx densely hairy; sepals slightly exceeding the bracts, elliptic, obtuse, concave, ciliate. Corolla slightly exceeding the sepals, cleft half-way down: lobes oblong, reflexed, hairy outside near the tips. Stamens

exserted, anthers oblong. Ovary 2-celled, 4-ovuled; styles 2, free from the base; stigmas capitate. Capsule .2 inch long, ovoid, pointed, pubescent at the apex; seed usually 1.

Plains of the Punjab; Dera Ismail Khan, Muzaffargarh, Multán, also near Agra. Flowers: February—March. Used for camel fodder. Tamarix seedlings are sometimes mistaken for this plant.

2. BREWERIA, R. Br.

(In honor of Samuel Brewer who is much praised by Dillenius in his *Historia Muscorum*. **DISTRIB.** Species about 25; warmer regions of the world.)

BREWERIA LATIFOLIA, Benth. ex C. B. Clarke, in Hook. f. *Fl. Brit. Ind.* IV (1883) p. 224.—A low erect much-branched shrub rarely reaching 1 foot high, stems and branches argento-canescent. Leaves .2-.5 inch long, elliptic-oblong, obtuse, thick, densely silky, base usually acute; petiole .05-.1 inch long. Flowers small, white or pinkish, 1-3 together, sessile in the upper axils; bracteoles 2, linear-lanceolate, acute, nearly .1 inch long. Calyx silky without, veined within; sepals .2 inch long, ovate, acuminate. Corolla scarcely, if at all exceeding the calyx, campanulate, limb 5-plicate, with hairy bands between the folds, lobes very short. Stamens included. Ovary 2-celled, 4-ovuled; styles 2, free nearly to the base; stigmas capitate. Capsule ovoid, acute, .2 inch long, pubescent near the apex, splitting to the base into 4-valves. Seeds usually 2.

Salt Range. There are no Punjab specimens in Herb. Dehra or Calcutta. Flowers: December.

3. PORANA, Burm.

(Said to be derived from the Javanese name of *P. volubilis*. **DISTRIB.** Species about 10; India, Malaya and Australia.)

PORANA PANICULATA, Roxb. *Cor. Pl.* III (1819) p. 81, t. 235.—An extensive evergreen twining shrub, twigs clothed with dense short grey tomentum. Leaves very variable in size, usually 2-4 by 1.5-2.5 inches, ovate, acuminate, base cordate, 3-7-nerved, entire, membranous, softly pubescent on both sides with short grey hairs which are more copious beneath, ultimately when fully grown nearly glabrous except on the nerves; petiole very variable, sometimes 4 inches long, tomentose. Flowers .15-.2 inch across, white, very numerous, in large axillary and terminal drooping panicles. Bracts leaf-like, persistent; bracteoles subulate, small. Sepals .05-.08 inch long, linear-oblong, grey-tomentose, 3 sepals greatly enlarged in fruit. Corolla .2-.25 inch long, campanulate, limb 5-plicate, pubescent externally, lobes short. Anthers included, small, straight. Disk annular, minute. Ovary 2-celled, 4-ovuled; style short, undivided; stigma capitate, 2-lobed. Capsule .3 inch long.

ovoid, tipped with the style, minutely pubescent, supported by 3 enlarged sepals; one sepal .7 inch long .2-.3 inch wide, membranous, with 1 longitudinal and several lateral inarched nerves, the other two sepals linear as long as the capsule. The *Bridal Wreath*.

Sub-Himalayan tract from the Indus eastwards. Abundant in the Kangra District; rare in Hazara but occurs in the Khanpur Range. Flowers: October—December. A very beautiful object when in flower especially along the Beas in Kangra where it festoons the scrubby vegetation on the hills near the river with dense masses of white. The twigs are used for making baskets.

POBANA RACEMOSA, *Roxb.*—A herbaceous climber, puberulous or nearly glabrous. Flowers larger, white, in dichotomous racemes with sessile, cordate leafy bracts at the forks. Corolla nearly .5 inch long, lobed, half-way down. All 5 sepals enlarged in fruit with 3-5 strong longitudinal nerves.

"The *Snow-creeper* of the English, one of the most beautiful of Indian plants, the masses of dazzling white flowers resembling snow patches in the jungle." This plant has been collected at Nachar but is rare in the Punjab. According to Duthie, Fl. Upper Gang. Plain II, p. 103, it is a shrub but the specimens appear herbaceous.

4. RIVEA, Chois.

(In honor of Auguste de la Rive, a physiologist of Geneva. **DISTRIB.** Species about 10; India and South America.)

RIVEA HYPOCRATERIFORMIS, *Chois. Convolv. Orient. in Mém. Soc. Phys. Genève. VI (1834) p. 408.*—A large twining shrub; stems terete, grey silky-pubescent. Leaves 1-4 inches long, as broad as long or nearly so, orbicular, obtuse, emarginate or mucronate, usually broadly cordate at the base, entire, glabrous or nearly so above, more or less densely adpressed grey-silky hairy beneath, a gland on either side of the midrib at the base on the lower surface; petiole .5-2 inches long. Flowers 2 inches across, white, axillary, usually solitary. Peduncle .2-2 inches long; bracts 2, at the apex of the peduncle, linear, deciduous; pedicels .2-.5 inch long, jointed to the peduncle. Sepals .3 inch long, ovate-elliptic, obtuse, silky-hairy. Corolla 2.5-3 inches long, tube very long, glabrous or with a few scattered hairs outside, limb with rounded plicate lobes. Stamens included; anthers .25 inch long, linear-oblong, straight. Disk annular. Ovary 4-celled; ovules 4; style filiform; stigmas 2, linear-oblong, .1 inch long. Fruit .5 inch diameter, globose, brown, glabrous, polished, tipped with the style-base, breaking up irregularly. Seeds normally 4, surrounded by dry mealy white pulp.

Plains fairly common in hedges or growing over bushes, Salt Range, Hissar, Lahore, Changa Manga. Flowers during the rains, the flowers open at sunset and close and wither next morning.

5. LETTSOMIA, Roxb.

(In honor of John Coakley Lettson. DISTRIB. Species 13; India, China and the Malay Archipelago.)

LETTSONIA THOMSONI, *Clarke, in Fl. Brit. Ind.* IV (1883) p. 193.—A twining shrub, stems villous. Leaves 3-5 by 2-4 inches, ovate, acuminate, usually caudate, base more or less deeply cordate, entire, strigose on both sides, lateral nerves abruptly curved upwards near the margins of the leaf; petiole .5-3 inches long. Flowers 1-1.5 inches across, rosy-purple, in axillary peduncled usually 1-3-flowered heads. Peduncles 2-5 inches long, pubescent; pedicels usually very short; bracts .3-.5 inch long, oblong, much less hairy than the sepals, deciduous or sub-persistent. Sepals .5 inch long, ovate, acute, densely clothed with long soft grey or fulvous hairs, coriaceous and somewhat enlarged in fruit. Corolla 2 inches long, hairy outside, funnel-shaped, limb plicate, lobes shallow. Anthers included, straight. Disk annular. Ovary 2-celled, 4-ovuled; style long, filiform; stigmas 2, globose. Fruit a dry indehiscent berry; seeds 4-1.

Himalaya ascending to 4,000 feet and Sub-Himalayan tract from the Kangra District eastwards. Flowers: September—October.

CUSCUTA REFLEXA, *Roxb.*—A leafless parasite with long twining yellowish green stems and white sweet-scented flowers .2-3 inch long. Collett Fl. Siml., fig. 107. *Dodder.*

Very common on woody vegetation showing a marked preference for certain species, *e. g.*, *Zizyphus*, *Vicia*. It sometimes spreads considerably in coppice coupes and keeps back the young shoots though the damage is soon outgrown. In garden hedges it is a more serious nuisance and the only remedy when the attack is bad is to cut the hedge down to the ground. The seed germinates on the ground in the usual manner but as soon as the seedling has attached itself to a host plant the root dies and the plant becomes wholly parasitic.

IPOMŒA, *Linn.*—A large genus of about 300 species of twining herbs or shrubs. Corolla usually large, limb plicate. Stamens unequal, anthers often ultimately twisted. Ovary 2-celled, 4-ovuled, rarely 4-celled 4-ovuled; style filiform; stigma entire or 2-globose. Capsule 4-3- (rarely sub-2-) valved.

IPOMŒA SINUATA, *Ortega.*—An extensive twining shrub. Leaves 2-4 inches diameter, palmately cut nearly to the base into about 7 lanceolate pinnatifid segments, flowers about 1 inch across, white on axillary 1-2-flowered peduncles. Sepals .8 inch long, glabrous, elliptic-oblong. Corolla campanulate. Capsule .5 inch diameter, glabrous.

Indigenous to tropical America. Occasionally grown in gardens and sometimes found as an escape in hedges, &c., in moist places, *e. g.*, Changa Manga, Lahore, Madhopur.

IPOMŒA PALMATA, *Forsk.*—A slender climbing shrub. Leaves 1-3 inches diameter, cut nearly to the base into about 7 elliptic or lanceolate entire lobes. Flowers 2-3 inches across, purple, in axillary often 3-flowered cymes. Sepals .25 inch long, broadly ovate. Corolla campanulate. Capsule .5 inch long, ovoid, glabrous.

Indigenous or naturalized in most tropical countries. Cultivated in gardens in the plains and known as the "*Railway Creeper*" as is often the principal decorative plant grown at Railway Stations. Flowers almost all the year.

IPOMŒA CARNEA, Jacq.—A stout shrub with milky juice, suberect or climbing to a height of 20 feet. Leaves about 4 by 2 inches, ovate or ovate-lanceolate, long acuminate, base cordate, entire, glabrous, soft and somewhat fleshy; petiole about 2·5 inches long. Flowers large, rose, 2·5 inches long, 2 inches across, in axillary cymes, peduncles 2-4 inches long. Sepals ·2 inch long, broadly ovate. Corolla campanulate, narrowly cylindric for about ·2 inch at the base, suddenly widened at the top. Capsule ·5 inch long, glabrous. Seeds silky.

Indigenous to South America. Cultivated in the plains especially at Railway Stations. In flower all the year except the coldest months. Easily grown from cuttings.

IPOMŒA LEABII, Pers.—A climbing shrub. Leaves 3-5 inches long and broad, mostly deeply 3-lobed, pubescent on both surfaces, base cordate, apex acute; petiole slender, nearly as long as the blade. Flowers 3-4 inches long and as much across, bright violet-blue when fresh with five narrow pinkish bands, in axillary cymes. Sepal about ·7 inch long, linear-lanceolate. Corolla campanulate, suddenly widened at the mouth.

Indigenous to South America. Often cultivated in gardens in the plains and flowers very profusely.

LXIV. SOLANACEÆ.

Herbs or shrubs, erect, trailing or scandent, rarely trees, Leaves alternate or on flowering shoots usually in unequal pairs. never truly opposite, entire, lobed or pinnate; stipules 0. Flowers regular, bisexual, rarely unisexual, solitary or clustered or in cymes, often extra-axillary; bracts and bracteoles 0. Calyx inferior, limb usually 5-lobed or -toothed, usually persistent, often accrescent. Corolla very various in form, often plicate; lobes usually 5, contorted, induplicate-valvate or imbricate. Stamens 5, inserted on the corolla-tube; anthers ovate or oblong, dehiscent by apical pores or longitudinally. Ovary 2-celled or imperfectly 1- or 4-celled or rarely 3-5-celled; ovules many, on prominent peltate placentas; style simple; stigma usually 2-lobed or partite. Fruit a berry or capsule. Seeds often discoid with a pitted testa. **DISTRIB.** A fairly large family in the warmer regions of the whole world.

Corolla rotate or campanulate.

Calyx in fruit not overtopping the berry; stamens dehiscent apically ... 1. *Solanum*.

Calyx in fruit enclosing the berry; stamens dehiscent longitudinally ... 2. *Withania*.

Corolla-tube cylindric ... 3. *Lycium*.

1. SOLANUM, Linn.

(The classical name of *Solanum nigrum*, Linn.)

Herbs, shrubs or trees, prostrate, erect or climbing, armed or not. Leaves alternate or subopposite, entire, lobed or pin-natifid. Flowers white, yellow, violet or red, in cymes, racemes or panicles, rarely solitary. Calyx 5- or 10-toothed or -fid, unaltered or somewhat enlarged in fruit. Corolla rotate or widely campanulate, limb plicate usually 5-lobed. Stamens usually 5 in the corolla-throat; filaments short; anthers connivent or united, dehiscing by terminal pores or short slits. Ovary 2-celled, rarely in cultivated forms 3-4-celled; style columnar; stigma small. Berry globose or elongate, small or large. Seeds numerous, discoid. DISTRIB. Species over 700; warmer regions of the globe, most numerous in America.

Herbaceous members of this genus are *S. tuberosum*, Linn., the *Potato* and *S. Melongena*, Linn., the *Brinjal*. The latter when growing as an escape from cultivation is very prickly and much resembles *S. incanum* of which it is probably a cultivated form.

Unarmed.

- | | |
|------------------------------------|-----------------------------------|
| Subscandent, glabrous or nearly so | ... 1. <i>S. Dulcamara</i> . |
| Erect, woolly-tomentose | ... 2. <i>S. verbascifolium</i> . |

Prickly.

- | | |
|---|-------------------------------|
| Leaves exceeding 2 inches in length; calyx-lobes triangular, | |
| Flowers all bisexual, racemose; berries .3 inch diameter | ... 3. <i>S. indicum</i> . |
| Flowers polygamous, the bisexual solitary; berries .7-1 inch long | ... 4. <i>S. incanum</i> . |
| Leaves less than 2 inches long; calyx-lobes linear | ... 5. <i>S. gracilipes</i> . |

1. SOLANUM DULCAMARA, Linn. *Sp. Pl.* (1753) p. 185.—A sub-erect shrub with long climbing or trailing more or less herbaceous branches, glabrous or nearly so. Leaves 1-3 inches long, ovate or oblong, acuminate, entire, lobulate or almost pinnate, thin, membranous, base usually rounded, sometimes abruptly narrowed into the petiole or cordate; petiole .5-1 inch long, slender. Flowers .3-.5 inch across, purple, in laxly paniced drooping cymes 2-5 inches across. Peduncle .2-1 inch long, slender; pedicels .3-.5 inch long, filiform. Calyx less than .1 inch long, teeth very short, obtuse. Corolla .2-.3 inch long, deeply lobed; lobes oblong, obtuse, puberulous on the margins, reflexed. Filaments glabrous, anthers oblong, obtuse. Ovary and style glabrous. Berries .3 inch diameter, red, globose, glabrous, supported by the slightly enlarged saucer-shaped calyx. Seeds minutely pitted. *Woody Nightshade*.

Himalaya 6-8,000 feet from the Indus eastwards, in moist forest undergrowth. Common in Hazara and fairly common in Bashahr. Flowers: July—August. DISTRIB. Westwards to Europe and eastwards to Japan.

2. *SOLANUM VERBASCIFOLIUM*, *Linn. Sp. Pl.* (1753) p. 184.—A tall erect soft-wooded shrub or small tree, clothed almost all over with a dense yellowish-grey tomentum of scurfy stellate hairs. Leaves 4-10 by 2-5 inches, elliptic-lanceolate or elliptic-ovate, acuminate, entire, velvety-pubescent above, densely woolly beneath, base acute or sub-rhomboid, rarely rounded, lateral nerves about 8 pairs; petiole 1-2 inches long. Flowers about .5 inch across, white, in woolly dichotomous cymes about 2 inches across; peduncles 1-4 inches long, at first apparently terminal, afterwards becoming lateral; pedicels .1-2 inch long, stout. Calyx .25 inch long, densely woolly, turbinate, lobes .1 inch long, deltoid. Corolla about .5 inch long; lobes .3 inch long, elliptic-lanceolate, acute, tomentose on the backs. Filaments glabrous, anthers oblong, obtuse. Ovary hairy; style glabrous. Berries .3-.5 inch diameter, globose, yellow, stellately pubescent, supported by the cup-shaped calyx, the lobes of which are enlarged but much shorter than the berry.

Sub-Himalayan tract and adjacent plains from the Indus eastwards, in moist shady places, ascending to 5,000 feet in the hills. This plant with the increase of irrigation is extending its range. It is fairly common along water-channels in Changa Manga and in similar places elsewhere. In flower or fruit throughs out the year.

3. *SOLANUM INDICUM*, *Linn. Sp. Pl.* (1753) p. 187.—An erect woody undershrub 1-6 feet high, branches tomentose armed with recurved prickles .2 inch long. Prickles on the petioles and leaves, yellowish, straight. Leaves 2-6 by 1-3 inches, ovate, subentire, sinuate or lobed, stellately pubescent above, tomentose beneath; base cordate, truncate or cuneate, often unequal-sided; petiole .5-1 inch long. Flowers .7-1 inch across, blue, in extra-axillary racemose cymes 1.5-2 inches long; pedicels .3-.5 inch long, tomentose, often prickly. Calyx .15 inch long, tomentose, teeth triangular, acute. Corolla .3-.5 inch long, stellately hairy without, nearly glabrous within; lobes as long as the tube, oblong, sub-acute. Filaments very short, glabrous; anthers oblong-lanceolate. Ovary often hairy at the top; style stellately hairy, curved at the apex. Berries .3 inch diameter, globose, yellow when ripe, glabrous or with a few stellate hairs at the apex, supported by but much exceeding the usually prickly calyx. Seeds very minutely and inconspicuously lacunose.

Sub-Himalayan tract and plains, fairly common in waste places. In flower or fruit all the year round.

4. *SOLANUM INCANUM*, *Linn. Sp. Pl.* (1753) p. 188.—A plant closely resembling *S. indicum*. Peduncles usually paired, one bearing a solitary fertile flower and the other usually a

racemose cyme of male flowers. Calyx .3 inch long, cleft nearly half-way down. Corolla .7 inch long; lobes short, broadly deltoid, tomentose outside except on the broad infolded portion, tomentose towards the tips within. Berries .7-1 inch diameter, globose, yellow. Seeds minutely pitted. Otherwise as for *S. indicum*. *S. coagulans*, Forsk. Fl. Brit. Ind. IV, p. 286.

Sub-Himalayan tract and plains from the Indus eastwards. Salt Range, Pabbi Hills. Fairly common. In flower or fruit all the year round. The cultivated *Brinjal*, *S. Melongena*, Linn., is a herbaceous plant with white or nearly black globose or ellipsoid fruits but does not appear to differ from *S. incanum* in any constant character. When neglected it is apt to produce small yellow fruits much like those of *S. incanum*.

5. *SOLANUM GRACILIPES*, Dcne. in *Jacquem. Voy. Bot.* (1844) p. 113, t. 119.—An undershrub with slender branches stellately scurfy-tomentose when young and more or less armed with straight or recurved prickles with broad conical bases. Leaves .7-1.5 inches long, suborbicular, obtuse, more or less stellately pubescent on both sides or glabrous, base cordate, truncate or cuneate; petiole .7-1.2 inches long, slender, stellately tomentose, sometimes prickly, very narrowly winged in the upper part by the decurrent leaf-blade. Flowers .6 inch across, white or lavender, in few-flowered fascicles, sometimes solitary; pedicels filiform, .7-1.5 inches long, tomentose, not prickly. Calyx .2 inch long, pubescent, lobes linear from a triangular base. Corolla .4 inch long, stellately pubescent outside, cleft more than half-way down; lobes oblong, subacute. Filaments almost 0; anthers linear-oblong. Ovary glabrous or with a few stellate hairs at the apex; style glabrous. Berry .25 inch diameter, globose, glabrous, orange-red. Seeds minutely tuberculate.

Plains of the Punjab from the Jhelum westwards. Sind, Trans-Indus. Flowers: December—January. Grows under the shelter of large bushes, not common. Has been found at Multan and Kot Lakhpat.

The following woody climbers belonging to this genus are cultivated:—

SOLANUM JASMINOIDES, *Pant.*—Leaves 1.5-2 inches long, ovate-lanceolate, glabrous except in the axils of the nerves beneath. Flowers .6 inch across, white, in many-flowered cymes. Calyx-lobes ovate, small.

A native of Brazil. Grown in gardens in the plains and hills. Flowers: March. Commonly cultivated in Simla, flowering in August—September.

SOLANUM SEAFOETHIANUM, *Andr.*—Leaves including the petiole 4-5 inches long, pinnate below, lobed in the upper half, lobes and leaflets 7-9, glabrous or nearly so. Flowers .5 inch across, blue, in many-flowered cymes. Calyx cyathiform, lobes subobsolete. Berries .4 inch diameter, globose, red.

A native of tropical America. Does well in the Sub-Himalayan tract but not very well in the plains. A variable plant in its habitat; the above description only covers the form cultivated in India. Flowers: August.

Several erect shrubby species are cultivated in gardens :—

SOLANUM PSEUDOCAPSICUM, Linn.—An erect much branched bushy shrub, 2-3 feet high. Leaves 2-2½ inches long, lanceolate, narrowed at both ends, glabrous, entire or sinuate; petiole short. Flowers 4 inch across, extra-axillary, solitary or in 2-4-flowered cymes; pedicels 2 inch long in flower, 5 inch long in fruit. Calyx 2 inch long, cleft two-thirds the way down; lobes oblong-lanceolate, slightly enlarged in fruit, spreading or reflexed. Corolla deeply 5-lobed, white. Berries 5 inch diameter, bright-red, globose.

Native country uncertain. Indigenous or naturalized in Australia, South Africa, China, Bourbon, Madeira, the Azores and Brazil. Comparatively recently introduced in Simla and grown for its brightly colored berries; planted near native huts at Simla and spreads freely down the hillside into Government Forest. It is likely to become abundant as it is apparently not eaten by cattle or goats.

SOLANUM RANTONNETII, Carr.—An erect shrub 6 feet high. Leaves 2-3 by 8-12 inches, rhomboid-lanceolate, narrowed at both ends; petiole 5 inch long. Flowers 8 inch across, purple, on slender pedicels 5 inch long. Calyx cyathiform, teeth minute. Corolla funnel-shaped, 5-angled.

Indigenous to Argentina. Cultivated in the plains and flowers very freely from May to August.

2. WITHANIA, Pauq.

(In honor of H. Witham, a British geologist and writer on fossil botany of the 19th century.)

Unarmed shrubs or undershrubs, often hoary tomentose. Leaves entire. Flowers small, fascicled, shortly pedicelled, sometimes dioecious. Calyx campanulate, 5-6-toothed, accrescent in fruit. Corolla campanulate, lobes 3-6, short, valvate. Stamens inserted at the base of the corolla-tube; anthers dehiscent longitudinally. Ovary 2-celled; ovules numerous; style linear; stigma shortly 2-fid. Berry globose, enclosed in the enlarged calyx. Seeds discoid. **DISTRIB.** Species 5; S. Europe, W. Asia in warm dry regions, Africa and the Canary Islands.

Leaves thin, ovate; flowers bisexual; berry loosely enclosed in the calyx ... 1. *W. somnifera*.

Leaves thick, oblong-lanceolate; flowers unisexual; berry tightly enclosed in the calyx 2. *W. coagulans*.

1. **WITHANIA SOMNIFERA, Dunal, in DC. Prodr. XIII part 1 (1852) p. 453.**—An evergreen undershrub 1-5 feet high, branches clothed with mealy stellate hoary tomentum. Leaves 2-5 by 1-3 inches, ovate, subacute, entire, thin, more or less pubescent especially along the nerves, base narrowed into the petiole; petiole 3-1 inch long. Flowers greenish or lurid-yellow, 2 inch across, usually about 5 together in a sessile or nearly sessile umbellate cyme; pedicels 0-2 inch long. Calyx in flower 2 inch long, mealy-tomentose; teeth acute, nearly equalling the tube. Corolla 25 inch long; lobes very short,

tomentose outside. Anthers broadly elliptic, shorter than the filaments. Stigma clavate. Berries .25 inch diameter, red, globose, smooth, enclosed in the inflated membranous calyx which reaches more than 1 inch diameter and is globose, slightly 5-angled, pointed with the connivent calyx-teeth, scurfy-pubescent outside. Seeds .1 inch diameter, yellow, somewhat scurfy. Vern. *Agsend*, *aksan*.

Plains of the Panjab, common in weedy places, also in the Sub-Himalayan tract ascending to 5,000 feet. The roots are used medicinally and the fruit possesses the same property of coagulating milk as that of the following species. In flower or fruit throughout the year.

2. *WITHANIA COAGULANS*, *Dunal*, in *DC. Prodr.* XIII part 1 (1852) p. 685.—A rigid shrub 1-3 feet high, branches clothed with dense grey or yellowish tomentum. Leaves 1-3 by .4-2 inches, usually lanceolate-oblong, sometimes ovate, obtuse, entire, clothed with a minute persistent not easily detachable greyish tomentum which makes the leaves thickish, usually of a dull uniform greyish color on both sides, base narrowed into a stout petiole which is up to .5 inch long, but often indistinct. Flowers .3-.4 inch across, yellow, dioecious, in axillary clusters; pedicels 0-.2 inch long, deflexed, slender. Calyx in flower .2-.25 inch long, tomentose, teeth triangular, nearly half the length of the tube. Corolla .3-.4 inch long, stellately mealy outside, divided one-third the way down. Stamens in the male flowers equalling the corolla-tube, anthers oblong usually longer than the filaments; in female flowers scarcely half the length of the corolla-tube. Ovary in the male flowers without style or stigma; stigma mushroom-shaped, 2-lamellate in female flowers. Berries .3-.5 inch diameter, globose, red, smooth, closely girt by the enlarged somewhat leathery calyx which is scurfy-tomentose outside. Seeds .1 inch diameter, dark-brown, somewhat ear-shaped, glabrous. Vern. *panîrband* (=cheese-maker), *panîr*.

Plains of the Panjab between the Jhelum and the Indus, Salt Range. Common Trans-Indus. Also in the Sutlej valley, Nirth to Kilba and in Almora. The fruit is used as a substitute for rennet to coagulate milk. The distribution of this plant is curious and Brandis (*Indian Trees*, p. 715) says, "the locality Sutlej valley 3,000 feet requires verification." The Himalayan specimens tend to have larger somewhat thinner leaves, which are not so grey and smaller anthers; I can find no specific difference such as one might expect. A similar distribution is found in the case of *Capparis spinosa*. Flowers: November—April.

3. *LYCIUM*, Linn.

(From *Lukion*, a name given to *Rhamnus* by Dioscorides, as coming from Lycia, in Asia Minor. *DISTRIB.* Species 40; temperate and sub-tropical regions.)

LYCIUM EUROPEUM, *Linn. Sp. Pl.* (1753) p. 192.—A nearly glabrous shrub 4-6 feet high, twigs slender whitish or

pale-grey shining, armed with axillary and terminal slender sharp thorns which sometimes bear leaves and flowers. Leaves often fascicled on dwarf shoots, very variable, up to 2 by .5 inch, oblong-lanceolate, narrowed at both ends or oblong-spathulate and narrowed at the base or linear and acute or obtuse, glabrous or nearly so; petiole .1 inch long or almost 0. Flowers .3-.4 inch across, white or pale-purplish, solitary or in fascicles of 2-5; pedicels .2-.3 inch long. Calyx .1-.15 inch long, campanulate; teeth usually 5, triangular, acute, minute. Corolla .4-.5 inch long, cylindric, widened slightly upwards; lobes usually 5, .1-.15 inch long, spreading, imbricate. Stamens scarcely exerted, filaments glabrous. Ovary 2-celled, glabrous, seated on a large membranous cup-shaped disk; style glabrous, shortly exerted; stigma capitate, 2-lamellate. Berry .25 inch diameter, globose, bright-red, supported by the slightly enlarged calyx which is irregularly lobed or 2-lipped. Seeds many. *L. barbarum* of Fl. Brit. Ind. IV, p. 241, *ex-parte*, Vern. *Kangu*.

Plains of the Panjab, in dry places, Delhi, Hissar, Lahore, Changa Manga. Fairly common. Flowers: October—March. The fruit is edible. (I cannot distinguish the plant referred to *L. barbarum* by Cooke, Fl. Bomb. II, 272, from the above, nor do any of the Panjab specimens I have seen differ in important characters from *L. europæum*. The Baluchistan specimens also referred to *L. barbarum* are distinct, having the corolla funnel-shaped with lobes nearly as long as the tube and stamens distinctly exerted.)

CESTRUM, Linn.—Shrubs. Leaves alternate, entire. Flowers in cymes, axillary or fascicled running into terminal panicles or in lateral panicles. Calyx campanulate or tubular, 5-toothed or -fid. Corolla tubular-funnel-shaped, usuallys lightly widened evenly from the base upwards; lobes 5, short, spreading, induplicate-valvate. Stamens inserted in the middle of the tube or higher, included; anthers short. Ovary 2-celled; style filiform; stigma dilated. Fruit a berry. **DISTRIB.** Species 140; all American.

The *Cestrums* are free-flowering shrubs common in gardens. They are easily grown from cuttings. One species *C. Parqui*, *L' Herit.* I have found growing as if wild in Abbottabad.

CESTRUM AFRANTICUM, Lindl.—Leaves ovate-lanceolate, about 4 by 2 inches. Flowers .8 inch long, .4 inch across, orange. Calyx .3 inch long, tubular. Filaments pubescent in the lower adnate half, free above with a fleshy obtuse thick appendage at the base of the free portion.

Cultivated in Abbottabad, 4-6 feet high. Flowers in December.

CESTRUM PARQUI, L' Herit.—Leaves foetid when bruised, lanceolate, variable in size. Flowers .6 inch long, .4 inch across, dirty yellowish-green, lobes 5-6. Calyx .15 inch long, campanulate. Filaments pubescent in the lower adnate half, free above, tumid but not appendaged at the base of the free portion. Berry black, ovoid, .3 inch long.

Cultivated in Lahore and Abbottabad. 2-4 feet high. Flowers more or less throughout the year.

CESTRUM NOCTURNUM, Linn.—Leaves lanceolate, about 4 by 1·3 inches. Flowers 7 inch long, 4 inch across, pale-yellowish, very fragrant at night, in lateral nearly leafless or terminal more or less leafy panicles. Calyx 1 inch long, campanulate. Filaments with a line of hairs in the lower adnate portion, free and glabrous in the upper fourth with a long sharp conical tooth at the base of the free part.

• Cultivated in Lahore, 6-9 feet high. Flowers: August—October.

DATURA, Linn.—Herbs or shrubs. Leaves large, entire or coarsely sinuate-dentate. Flowers large, purple or white, solitary, erect or pendulous. Calyx long, tubular, herbaceous, 5-toothed; in fruit circumsciss above the base, the upper part deciduous. Corolla tubular-funnel-shaped, wide, plicate, entire or shortly lobed, lobes often acuminate. Stamens inserted near the base of the corollatube, included; filaments filiform; anthers linear, dehiscing longitudinally. Ovary 2-, or spuriously 4-celled; ovules many; style filiform; stigma 2-lobed. Fruit a capsule. **DISTRIB.** Species about 12; temperate and tropical.

Capsule ovoid or globose, echinate; coarse herbs or undershrubs.

Capsule deeply 4-valved erect; corolla 5-toothed.
Flowers white

... 1. *D. Stramonium.*

Flowers purple or blue

... 2. *D. Tatula.*

Capsule opening irregularly near the apex,
reflexed or spreading.

Plant densely greyish-green tomentose; corolla
white, 10-toothed; capsule with slender
spines

... 3. *D. Metel.*

Plant glabrous or nearly so; corolla 5-toothed,
usually purplish outside; capsule with blunt
tubercles

... 4. *D. fastuosa.*

Plant glabrous or nearly so; corolla 5-toothed,
white or creamy; capsule with sharp spines

5. *D. alba.*

Capsule lanceolate, smooth; a soft wooded-shrub

6. *D. suaveolens.*

1. **DATURA STRAMONIUM, Linn.**—A coarse annual 2-4 feet high, glabrous or puberulous. Leaves about 7 inches long. Corolla 3-6 inches long, white; lobes 5, cuspidate. Capsule erect, ovoid, covered with rigid long and short prickles. The *Thorn-Apple*. Vern. *dhatūra*.

Sub-Himalayan tract ascending to 9,000 feet. Common in waste places. The seeds are poisonous and are commonly used by criminals.

2. **DATURA TATULA, Linn.**—Similar to the above but stem usually tinged with purple. Leaves often cordate at the base. Flowers larger, bluish or purple. Prickles on the capsule mostly of one size.

Distribution as for the above but not so common.

3. **DATURA METEL, Linn.**—A coarse herb 3-4 feet high. Corolla 6 inches long, white tinged with green below, limb 10-toothed. Capsule globose.

Distribution as for the above. Supposed to be the most poisonous kind of *dhatūra*.

4. **DATURA FASTUOSA, Linn.**—Erect 4-5 feet high, stems woody below, purplish towards the tips. Leaves up to 8 inches long, ovate-lanceolate, acuminate, sinuate or repand-dentate, base unequally cuneate. Flowers erect, often double in cultivation. Calyx about 2 inches long, base reflexed in fruit.

Corolla 5-7 inches long, violet or purplish outside, white within, lobes 5, long-cuspidate. Capsule globose.

Cultivated in gardens and often found growing spontaneously. Old specimens are easily recognized by the woody stems.

5. *DATURA ALBA*, *Nees*.—Similar to the above and perhaps only a variety. Flowers always single, white or cream colored.

Distribution as for *D. fastuosa* from which according to Duthie Fl. Upper Gang. Plain II, p. 132, it also differs in being less woody and having a smaller calyx and corolla both of which are puberulous outside.

6. *DATURA SUAVEOLENS*, *H. & B.*—A shrub 6-8 feet high, branches stout. Leaves 5-8 inches long, elliptic, narrowed at both ends, subentire. Flowers white, very sweet-scented at night. Corolla 10 inches long, 5 inches across, pure white, pendulous. Fruit 4 inch long, lanceolate or narrowly oblong, not echinate.

Cultivated in gardens and grows easily from cuttings. A very showy easily-grown plant which thrives in wet places such as the banks of a stream. It does well in the Sub-Himalayan tract but badly in the plains. A native of Mexico.

CAPSICUM, *Linn.* (*The Chili*).—These plants are well-known and easily recognized by their pungent fruits. Numerous varieties are cultivated by Europeans and natives and are now usually referred to two species. Vern. *mirich*, *lāl mirich*.

CAPSICUM ANNUUM, *Linn.*—Pedicels solitary, erect or reflexed. Fruit erect, spreading or pendent, usually longer than the pedicels. Usually herbaceous sometimes suffruticose.

CAPSICUM FRUTESCENS, *Linn.*—Pedicels 2 or more, erect. Fruit always erect, shorter than the pedicel. Shrubby.

CYPHOMANDRA BETACEA, *Sendt.*—*The Tree Tomato*.—A South American shrub occasionally cultivated. In the plains it is a failure as it cannot resist the monsoon and in the hills it is usually killed by frost in the first winter but nevertheless will fruit if planted early and is useful in fruiting at a time when fruit and vegetables are scarce.

LXV. SCROPHULARIACEÆ.

Herbs rarely shrubs or trees. Leaves usually opposite; stipules 0. Flowers usually bisexual, pentamerous and zygomorphic. Calyx inferior. Corolla hypogynous, more or less 2-lipped. Stamens usually 4, didynamous, with or without a rudimentary fifth. Ovary usually 2-celled; ovules usually many. Fruit usually a capsule. *DISTRIB.* A large herbaceous family containing no indigenous woody plants but the following are cultivated:—

RUSSELLIA JUNCÆA, *Zucc.*—A shrub 3-4 feet high with long rush-like ribbed green stems, branches very slender, whorled. Leaves small, whorled, the upper opposite, 1 inch long, linear. Flowers 8 inch long, scarlet. Calyx 1 inch long, campanulate. Corolla tubular; limb small, 4 inch across, 2-lipped, sub-equally 5-lobed. Stamens 4, didynamous, included. Fruit a capsule.

Indigenous to Mexico. Commonly grown in gardens in the plains. Flowers freely most of the year.

RUSSELLIA SARMENTOSA, Jacq.—A shrub 3-4 feet high, with long ribbed green stems. Leaves opposite or whorled, 5-2.5 by 3-1.5 inches, ovate, acute, coarsely crenate-serrate; petiole 1-2 inch long. Flowers 3 inch long, scarlet, in axillary panicles composed of many-flowered racemes 5-2 inches long. Calyx 1 inch long. Corolla 1.5 inch across.

Indigenous to Mexico. Sometimes grown in gardens.

PAULOWNIA IMPERIALIS, Sieb. & Zucc.—A deciduous tree 40 feet high. Leaves opposite or ternate, large, up to 2 feet across on vigorous shoots, ovate, cordate, sometimes slightly lobed, softly tomentose on both surfaces becoming less hairy above when mature; petiole long. Flowers large, violet, appearing before the leaves. Corolla-tube 1.5 inches long, limb 2 inches across. Capsule nearly 2 inches long, ellipsoid, beaked.

Indigenous to Japan. Cultivated in Abbottabad. An ornamental plant of very rapid growth but requires good soil. Propagated by root-cuttings. Deserves to be more widely planted for ornament. It cannot stand the monsoon in the plains.

LXVI. BIGNONIACEÆ.

Trees or shrubs, very often climbing, very rarely undershrubs or herbs. Leaves decussate, usually compound, stipules 0. Leaflets usually entire. Flowers usually showy, zygomorphic, bisexual, in racemes or panicles, usually terminal; bracts 0. Calyx gamosepalous, often closed in bud and opening irregularly, or spathaceous. Corolla gamopetalous, usually tubular-ventriculose, somewhat 2-lipped; lobes 5, imbricate in bud. Stamens 4, didynamous, sometimes only 2 fertile, often with an imperfect (rarely perfect) fifth, inserted in the lower part of the corolla-tube; anthers 2-celled, dehiscing by longitudinal slits, cells parallel or divaricate. Disk usually present, annular or cushion-like. Ovary superior, 2-celled; ovules numerous; style long, glabrous; stigma of 2, elliptic, flattened lobes. Capsule usually elongate, loculicidally or septicidally 2-valved, valves separating from the septum which is thin or thick and corky. Seeds usually much compressed and prominently winged. **DISTRIB.** A large family of the tropics, most numerous in America, a few in warm temperate regions.

Leaves simple	... 1. <i>Tecoma</i> .
Leaves pinnate	... 2. <i>Stereospermum</i> .
Leaves 2-3-pinnate	... 3. <i>Oroxylum</i> .

1. *TECOMA*, Juss.

(Derived from a Mexican name *Tecomaxochitl*.)

Shrubs, rarely trees, erect or scandent. Leaves opposite, simple or pinnate; leaflets often dentate. Flowers in terminal racemes or panicles. Calyx tubular-campanulate, subequally 5-dentate. Corolla-tube elongate, straight or curved,

throat little or much dilated; lobes 5, erecto-patent or spreading. Stamens 4; cells at first parallel then divergent or divaricate. Disk usually annular. Capsule linear or narrowly elliptic, straight or curved, more or less compressed parallel to the septum. **DISTRIB.** Species 80; mostly American.

TECOMA UNDULATA, *G. Don, Gen. Syst.* IV (1837) p. 223.—A shrub or small tree, nearly leafless for a short time when in flower; bark on old stems dark-grey or reddish-brown, rough; twigs terete, rather slender. Leaves simple, 2-4 by .5-1 inch, sometimes smaller, oblong or linear-oblong, entire, glabrous, dull greyish-green on both sides, apex obtuse; petiole .3-.7 inch long, slender. Flowers 2-3 inches across, from pale-yellow to deep-orange, inodorous, in few-flowered corymbose racemes terminating short lateral branchlets; pedicels .3-.5 inch long. Calyx .4-.6 inch long, campanulate; lobes broadly ovate, obtuse. Corolla 1.5-2.5 inches long, campanulate; lobes subequal, spreading. Stamens exserted; anther-cells divergent pendulous. Disk cup-shaped. Capsule 8-12 by .4 inch, slightly curved, smooth. Valves thin. Seeds .7-1.2 by .3-.4 inch including the membranous wing which extends all round the nucleus and is elongated at the ends, nucleus .3-.4 by .2-.25 inch, much compressed. *Tecomella undulata*, Seem. Vern. *Lahura*.

From Delhi along the Siwaliks and Outer Himalaya ascending to 4,000 feet to the Indus. Salt Range. Not common in the Punjab but frequent Trans-Indus. Usually a large shrub found in small patches but when cultivated reaches 7-8 feet in girth and 40 feet in height. Wood greyish or yellowish-brown, close-grained, mottled with lighter streaks, tough, strong and durable, works and polishes well. The plant seems to be remarkably resistant to fire. I have seen specimens 10-15 feet high growing amongst shrubs of almost the same height which had been killed or badly injured by fire though the *Tecoma* showed no signs of even having been scorched. According to Brandis it is easily raised from seed or cuttings, and as it stands drought well it should be useful for afforestation works. Planted occasionally in gardens for ornament. Flowers: March—April.

Several exotic members of the genus are to be seen in gardens.

TECOMA STANS, *Juss.*—A large shrub or at times a small tree. Leaves 7-10 inches long, pinnate. Leaflets usually 7, 3-4 by .7-1.5 inches, lanceolate, long-acuminate, serrate, glabrous or pubescent. Flowers 1 inch across, yellow, in terminal panicles. Calyx .15 inch long, teeth very small. Corolla 1.5-2 inches long; tube short, slender; throat ample, campanulate. Capsule 6 by .3 inch, rather strongly compressed. *Stenolobium stans*, Seem.

Native of Tropical America. Often grown in gardens in the plains and flowers freely. It is naturalised in some parts of India but not in the Punjab as yet. Flowers: September—April.

TECOMA RADICANS, *Juss.*—A deciduous shrub climbing by means of adventitious roots. Leaflets 7-11, 1.5-4.5 by .8-1.8 inches, ovate, acuminate, coarsely serrate, somewhat hairy on the nerves beneath. Flowers 2 inches

across, scarlet and orange, in terminal corymbs. Calyx nearly 1 inch long, tubular, cleft one-third the way down, teeth with several conspicuous glands on the backs. Corolla 2·5-3 inches long, straight. Stamens included. *Campsis radicans*, Seem.

Indigenous to North America. Cultivated in Lahore and Abbottabad. Flowers: September.

TECOMA GRANDIFLORA, *Pelun*.—Very similar to *T. radicans* but leaflets glabrous; calyx 1·3 inches long, cleft nearly half-way down, lobes eglandular; corolla broader and shorter, not twice as long as the calyx. *Campsis chinensis*, Voss.

Indigenous to China and Japan. Cultivated in gardens in the plains and in the hills. Flowers: September.

TECOMA CAPENSIS, *Lindl.*—A rambling shrub 6 feet high. Leaves 2·5 inches long, leaflets 5·9, 5·1-2 inches long, broadly elliptic, obtuse, serrate, bearded in the axils of the nerves beneath, the terminal leaflet larger 7·2 inches long, acuminate. Flowers 1 inch across, orange-red or scarlet. Calyx 2·25 inch long, lobes deltoid. Corolla 1·5-2 inches long, curved. Stamens and style exerted. *Tecomaria capensis*, Spach.

Indigenous to South Africa. Cultivated rather frequently in gardens. Flowers: September.

TECOMA AUSTRALIS, *R. Br.*—Twining, glabrous. Leaflets usually 5·9, ovate-oblong or lanceolate, usually entire. Flowers whitish with red or purple spots or streaks. Corolla-tube 4·8 inch long; limb 4·8 inch across. *Pandorea australis*, Spach.

Occasionally cultivated. Indigenous to Australia. Flowers: March.

TECOMA JASMINOIDES, *Lindl.*—Similar to the above but larger. Flowers pale rose, deep red in the throat. Corolla-tube over 1 inch long; limb nearly 2 inches across. *Pandorea jasminoides*, K. Schum.

Occasionally cultivated. Indigenous to Australia. Flowers: June.

2. STEREOSPERMUM, Cham.

(From the Greek *stereos*, rigid, and *sperma*, a seed; the seeds are thicker than is usually the case in this family. *DISTRIB.* Species about 12; tropical Asia and Africa).

STEREOSPERMUM SUAVEOLENS, *DC. Prodr.* IX (1845) p. 211.—A medium-sized or large deciduous tree; bark grey, exfoliating in large irregular scales; young parts viscous-hairy. Leaves opposite, 12-24 inches long, imparipinnate. Leaflets 5·9, 8·6 by 2·3·5 inches, broadly elliptic, abruptly short-acuminate, entire, coriaceous, scabrid above when mature and pubescent on the veins beneath, base usually unequal-sided; petiolules 1·1-3 inch long, stout. Flowers about 8 inch across, purple, sweet-scented, in large terminal viscidly hairy lax trichotomous panicles. Calyx 3 inch long, campanulate, viscidly hairy; lobes 3-5, short, broad. Corolla 1·1·5 inches long, funnel-shaped, pubescent outside and bearded within on the lower side; limb oblique, 2-lipped, lobes rounded with curled edges, the 3 lower longer than the 2 upper. Stamens 4, with a rudimentary 5th, didynamous, included; anther-cells much divergent. Disk cupular, fleshy. Ovary 2-celled; ovules many in

each cell, 2-seriate. Capsule 12-24 inches long, .7 inch diameter, cylindric, turgid, straight, rough with elevated pale specks, loculicidally 2-valved; valves hard; dissepiment spongy, filling the whole capsule, ultimately free from the valves. Seeds 1.5 by .3 inch including the membranous wing at each end; nucleus thick, transverse to the wing, grooved on one side and with a prominent ridge on the other which fits into a pit in the placenta. Vern. *Pádal*.

Sub-Himalayan tract from the Rawalpindi district eastwards. Scarce except in the Kangra district where it is rather frequent. In Kangra it is frequently mistaken by natives for *Cassia Fistula* which it resembles very superficially in foliage and fruits but differs amongst other things, in having opposite leaves. The tree is much lopped for fodder. The leaves in young plants and seedlings are serrate. The wood is hard, sapwood large, grey, heartwood yellowish-brown. It is said to be durable and to give excellent charcoal but appears not to be appreciated in the Punjab. Cultivated in gardens and reaches a large size but as a wild tree it is usually small. Flowers: May—June.

3. *OROXYLUM*, Vent.

(From the Greek *oros*, a mountain, and *xulon*, wood; referring to the supposed habitat. DISTRIB. Species 2; one in China and the following in India, Malaya and Cochinchina.)

OROXYLUM INDICUM, Vent. *Dec. Gen. Nov.* (1808) p. 8.—A small deciduous tree; bark brown, corky, soft. Leaves opposite, 40-60 inches long, 2-3-pinnate; pinnæ opposite, 3-4 pairs, the 2-3 lower pairs bipinnate at the base; the pinnules 3-5-foliate. Leaflets 2.5-5 by 1.5-4 inches, broad-ovate or elliptic, acuminate, base rounded, glabrous; petiolules of the lateral leaflets .2-.6 inch long. Flowers 2-3 inches across, lurid-purple, fleshy, foetid, in large erect terminal pedunculate unilateral racemes; peduncle 2-3 feet long, stout, hollow; pedicels .2-1.2 inches long. Calyx 1 inch long by .7 inch diameter, coriaceous, tubular-campanulate, persistent, limb truncate or obscurely toothed. Corolla up to 4 inches long, campanulate; lobes 5, rounded, crisped, toothed, subequal, about 1.5 inches long. Stamens 5, slightly exserted, all fertile, one a little smaller than the other 4; anther-cells parallel. Disk large, cushion-like. Ovary 2-celled, subsessile, contracted below; ovules numerous, many-seriate. Capsule 18-30 inches long by 2.5-3.5 inches broad, flattened, scabard-like, septicidally 2-valved; valves almost woody. Seeds very thin and flat, winged all round except at the base, 2-2.5 inches across the wing. Vern. *Tat palángá* (Ka).

Sub-Himalayan tract from the Ravi eastwards, not uncommon in hedges and scrub jungle. A small ungainly tree usually 20 feet high and 12 inches girth with a few branches near the top of the stem. Conspicuous for the greater part of the year owing to its huge capsules which are borne on the long peduncle well above the foliage. Growth fast, wood soft, not used. The seeds are used to line hats and to cover umbrellas. Flowers: June—August.

MILLINGTONIA HORTENSIS, *Linn. f.*—A tallerect evergreen tree; bark corky. Leaves opposite, 2-3-pinnate, up to 3 feet long. Leaflets 1-2 inches long, ovate, acuminate, sinuate or erenate, membranous, pubescent when young, nearly glabrous when mature. Flowers 1 inch across, white, fragrant, in many-flowered panicles, terminal on the pendent branches. Calyx 1 inch long, campanulate; teeth 5, obscure. Corolla 2-3 inches long, the tube very slender, cylindric; lobes 5, subequal, ovate, acute. Stamens 4, shortly exserted; anthers of 1 ovate cell, the second cell appearing as a small hook. Disk small, cushion-like. Stigma exserted. Fruit not produced in North India. The *Indian Cork tree*.

Believed to be indigenous to Burma and Malaya. Commonly cultivated in gardens and propagated by root-suckers which are freely produced. The tree is sometimes used as a roadside tree for which it is excellent but rather brittle. Flowers: February—March.

BIGNONIA, *Linn.*—Climbing shrubs. Leaves opposite, simple, 2-foliate with a tendril in place of the terminal leaflet, 3-foliate or pinnately compound but with few leaflets. Flowers showy, in axillary cymes and terminal panicles. Calyx campanulate or tubular, limb usually truncate or shortly 5-toothed. Corolla-tube usually elongate, widened upwards. Stamens 4, usually included. Capsule linear, compressed parallel to the septum, septifragal. **DISTRIB.** Species 120; American, with a few exceptions all tropical.

BIGNONIA VENUSTA, *Ker-Gawl.*—An evergreen shrub, climbing by means of tendrils. Leaves, the lower 3-, the upper 2-foliate with a tendril between the leaflets. Tendrils 3-fid at the apex, each branch ending in a minute hook. Leaflets 3-5 by 2 inches, ovate, acuminate, gland-dotted, base sub-5-nerved; petiolules 1 inch long, as long as the common petiole. Flowers 2-3 inches long, orange-red, in terminal corymbose racemes. Calyx 2 inch long; teeth minute, villous. Corolla slightly curved upwards, 5 inch or less across the throat; lobes 5 inch long, 2 inch broad, oblong, villous on the margins. Stamens longer than the corolla-tube, nearly equalling the upper lip. *Pyrostegia ignea*, Presl.

Indigenous to Brazil. Commonly cultivated in gardens and very conspicuous when in flower. Flowers: February—March.

BIGNONIA SPECIOSA, *R. Grak.*—Leaves bifoliate with a tendril between the leaflets, sometimes one-foliate. Tendrils unbranched. Leaflets 2-4 inches long, oblong or obovate-oblong; petiolules .05-.3 inch long; common petiole .1-.7 inch long. Flowers 2 inches across, lilac with darker veins, terminal, geminate. Calyx-tube 2 inch long; teeth .1 inch long, linear-subulate. Corolla 2.5-3 inches long, minutely pubescent within and without. Stamens included.

Indigenous to Brazil. Occasionally cultivated in gardens. Flowers: March—April.

BIGNONIA TWEEDIAANA, *Lindl.*—Leaflets 2, about 2 inches long, lanceolate, acuminate, sometimes with a trifid tendril continuous with the petiole. Pedicels axillary 1-flowered. Flowers large, yellow, 2 inches long and as much across.

Indigenous to Brazil. Occasionally cultivated. Flowers: April.

DOLICHANDRA CYNANCHOIDES, *Cham.*—A climbing shrub. Leaflets 2, mostly .6-1.2 inches long, with or without a trifid tendril between them; petiole .2-5 inch long. Flowers in axillary few-flowered cymes. Calyx .7 inch long, spathaceous. Corolla 1.5 inches long, 1 inch across, tubular-funnel-shaped, d. lil red.

Indigenous to South America. Cultivated for its foliage rather than for its flowers. It clings close to walls and covers them densely. Flowers: September.

CATALPA, Juss.—(The Indian name for one of the species.) Trees or shrubs. Leaves opposite or in the whorls of three, entire or lobed. Flowers showy, in terminal panicles. Calyx campanulate, closed in bud, splitting irregularly or 2-partite in flower. Corolla oblique, tube very short, throat ample; limb 2-lipped, upper lip 2-fid, lower 3-partite, lobes crisp, subequal. Stamens 2 perfect; staminodes 3, small; disk inconspicuous. Capsule linear, long, terete, valves coriaceous, loculicidally dehiscent. Seeds winged at the ends, the wings ending in a fringe of hairs. *DISTRIB.* Species 10; China, Japan, North America and the West Indies.

Catalpa speciosa has been introduced from time to time and has been cultivated by the Forest Department. As the seed is in considerable demand in America and as the seed of other species of *Catalpa* is more easily collected substitution by seed dealers is common. Some of the references to *C. speciosa* in annual forest administration reports certainly refer to other species of *Catalpa* and no experiments with *C. speciosa* can be taken as conclusive until the plants have flowered and been shown to be *C. speciosa* without doubt.

Flowers large, over 1 inch long, ground color (excluding spots) white; leaves usually unlobed.

Flowers in few-flowered panicles; calyx usually villous or pubescent; capsule .5-.7 inch diameter; leaves caudate-acuminate ... 1. *C. speciosa*.

Flowers in many-flowered panicles; calyx glabrous; capsule .25-.3 inch diameter; leaves acute ... 2. *C. bignonioides*.

Flowers smaller, about .7 inch long, ground color yellowish; leaves usually somewhat 3-lobed ... 3. *C. Kampferi*.

1. *CATALPA SPECIOSA, Warder ex Engelm.*—A large deciduous tree. Leaves 10-12 by 7-8 inches, broadly ovate with a caudate acumen about .5 inch long, usually entire, marked with clusters of dark glands in the axils of the nerves beneath; petiole 4-6 inches long or sometimes longer than the blade. Flowers about 2 inches long by 2.5 inches across, in lax few-flowered panicles 5-6 inches long. Calyx usually villous or pubescent. Corolla white, marked within by yellow blotches and purple spots. Capsule 8-20 by .5-.7 inch, valves thick. *The Hardy Catalpa.*

Indigenous to the United States. In its native country this tree has been much planted and is appreciated owing to its power to withstand drought and grow rapidly, it also produces a valuable timber. As its success in America is constantly being referred to in forest literature it has been introduced into India on several occasions and it is likely to receive attention from time to time in the future. It has been grown since 1880 in the Changa Manga Rest-House compound but the trees although they flower and fruit freely are small and stunted. The Punjab plains are apparently too hot for it to thrive. There are a few trees in Abbottabad growing remarkably well in a private garden and producing natural seedlings in some abundance. The tree has a large deep root-system and requires a deep soil and as the climate of the plains does not appear to suit it, it is unlikely to be of much use in the Punjab. For gardens in the hills it may be useful as it is handsome when in flower. Flowers: April.

2. *CATALPA BIGNONIODES*, *Walt.*—A small tree with short stem and large spreading branches. Leaves 5-8 by 4-6·5 inches, occasionally larger, apex rounded or rather abruptly acute, axils of the nerves beneath bearded. Flowers 1·3-2 inches long; 2-2·5 inches across, in compact many-flowered panicles 8-10 inches long. Calyx glabrous. Capsule 6-20 by 2·5-3 inch, valves thin. Otherwise as for *C. spectiosa*.

Indigenous to the Southern United States along rivers. Cultivated in the Simla District in gardens and in Lahore. As a forest tree this species is of very little value owing to its crooked growth.

2. *CATALPA KEMPFERI*, *Sieb. & Zucc.*—A large deciduous shrub 20 feet high. Leaves variable, 4-12 by 3·5-9 inches, ovate, acuminate, often more or less 3-lobed, nerves glandular in the axils beneath; petiole 2-9 inches long. Flowers about 7 inch long, in many-flowered compact panicles 4-5 inches long. Corolla yellowish, with orange blotches and purple spots. Capsule 9-12 by 1·5 inch, valves thin. *C. ovata*, D. Don.

Indigenous to Japan. Cultivated in Abbottabad. The plant being a shrub is of no forest importance. Flowers: April—May.

HETEROPHRAGMA ADENOPHYLLUM, *Seem.*—A medium-sized deciduous tree. Leaves opposite, imparipinnate, 1-2 feet long. Leaflets 5-7, with often a pair of small auricle-like leaflets at the base of the petiole, very variable in size, 3-10 by 1·8-7 inches, the terminal usually much the largest, elliptic or elliptic-oblong, apex rounded or acuminate, entire or undulate, more or less pubescent beneath, the lateral sessile. Flowers 2·5-3 inches across, yellowish-brown, in erect terminal brown-tomentose panicles. Calyx 5-1 inch long, campanulate, brown-tomentose outside, irregularly 3-5-lobed. Corolla densely brown-tomentose outside, tube 1·5 inches long; lobes 5, rounded, subequal. Stamens 4; anther-cells divergent. Capsule 1-3 feet long, cylindric, ribbed, twisted, loculicidally 2-valved, densely brown-tomentose.

Indigenous to Burma and the Andamans. Cultivated in the East Punjab as far as Lahore. Not quite frost hardy in Lahore. Flowers: November.

KIGELIA PINNATA, *DC.*—A medium-sized evergreen tree. Leaves opposite, imparipinnate, 6-12 inches long. Leaflets 7-9, 2-5 by 1-2 inches, oblong, abruptly short-acuminate, base unequal-sided, scabrid on both sides, the lower leaflets shortly petiolulate, the upper sessile. Flowers 4-6 inches across, dull liver-colored, in very long lax pendulous racemes 2-6 feet long; pedicels 2·5 inches long, clustered. Calyx 1·5 inches long, campanulate, coriaceous, glabrous, closed in bud; limb in flower oblique, 2-5-fid, lobes unequal. Corolla-tube short; throat broadly campanulate; limb sub-bilabiate; lobes 5, spreading. Disk thick, annular. Stamens 4, slightly unequal; anther-cells parallel or nearly so. Ovary 1-celled; placentas 2, parietal, deeply intruded and meeting in the centre of the cell. Fruit very large, elongate, woody, indehiscent. Seeds not winged, embedded in pulp. The *Cucumber* or *Sausage Tree*.

Indigenous to Tropical Africa. Grown in gardens as far west as Lahore, where it seldom if ever produces its fruits. A handsome tree of rapid growth and producing good wood. It can be recommended for planting in the east of the Province. Flowers: May—August.

JACARANDA OVALIFOLIA, *E. Br.*—A large shrub or small tree. Leaves 1-2 feet long, bipinnate, rachis grooved above. Pinnæ usually opposite, even in number by the abortion of the tip of the leaf, 14-24 pairs, 2-6 inches long, rachises narrowly winged and grooved above. Leaflets 5-26 pairs and an end one, about 5 by 1·5 inch, oblong, narrowed at both ends, cuspidate, paler beneath, minutely pubescent and ciliate, the terminal larger linear-lanceolate. Flowers rather over 1 inch across and 1·5 inches long, various shades

of mauve, in large erect terminal panicles. Calyx 1 inch long, 5-toothed. Corolla-tube curved, throat wide; limb 2-lipped; lobes 5, nearly equal. Stamens 4, included; anthers 2-celled, cells very unequal, one reduced and sterile; staminode very long, clavately thickened and hairy at the top. Capsule ovate, obtuse, 3 by 2 inches, compressed at right angles to the septum, loculicidally dehiscent. *J. mimosæfolia*, D. Don.

Indigenous to Brazil and Argentina. Frequently planted in gardens, at railway stations, etc. Flowers: April.

LXVII. ACANTHACEÆ.

Herbs, shrubs or rarely trees. Leaves opposite, rarely whorled, stipules 0. Flowers bisexual, more or less zygomorphic, in cymes, racemes or spikes, rarely solitary; bracts large or small, sometimes 0; bracteoles usually 2. Calyx usually 4- or 5-partite. Corolla obliquely 5-lobed or more or less distinctly 2-lipped; lobes imbricate or contracted in bud. Stamens 4 or 2 (with sometimes 2 staminodes), inserted on the corolla-tube, anthers 2- or 1-celled. Disk almost always present but often very small. Ovary superior, 2-celled; ovules 1-many, usually 2 in each cell; style simple, filiform; stigma 2-lobed, the lobes often unequal or 1-lobed by abortion. Fruit a loculicidal capsule, the valves often elastically recurved, the septum splitting, the seeds borne on each half. Seeds usually orbicular, compressed, in most genera attached to curved hardened supports (*retinacula*). **DISTRIB.** A large family of tropical and warm regions.

In most genera cystolith-cells are found in the epidermis or parenchyma of the leaves. They are visible as raised lines usually paler in color than the rest of the dry leaf. In the living plants the cystoliths are often inconspicuous even in some cases where they are easily seen in dry specimens. The appearance of the cystoliths in the following descriptions refer to dry specimens.

Calyx of 4 sepals, the outer pair the largest.

Leaves opposite; stamens 2

... 1. *Barleria*.

Leaves whorled; stamens 4

... 2. *Blepharis*.

Calyx 5-partite.

Corolla-lobes subequal.

Stamens 2; bracts white with green veins... 3. *Dactacanthus*.

Stamens 4.

Ovules or seeds 4

... 4. *Strobilanthes*.

Ovules or seeds more than 4

... 5. *Æchmanthera*.

Corolla distinctly 2-lipped.

Bracts not cuspidate.

Flowers orange; ovules 12-14

... 6. *Phlogacanthus*.

Flowers white; ovules 4

... 7. *Adhatoda*.

Bracts cuspidate; corolla white with purple spots

... 8. *Lepidagathis*.

1. *BARLERIA*, Linn.

(In honor of J. Barrelier, a French botanist of the 17th century.)

Shrubs or undershrubs, armed or not. Leaves opposite, entire. Flowers showy, sessile, solitary or in dense or rather lax spikes; bracts and bracteoles large, small or 0. Calyx 4-partite almost to the base; lobes in opposite pairs, the outer pair much the larger, the anterior often emarginate, bifid or deeply 2-lobed. Corolla elongate, sometimes very long, funnel-shaped upwards; lobes 5, subequal, imbricate in bud. Stamens 2 fertile with oblong 2-celled anthers; usually 2 staminodes occasionally containing a little pollen also present and often a rudimentary 5th. Disk large, cupular, half embracing the ovary, often with a toothed margin. Ovary 2-celled; ovules 2 in each cell; style long; stigma 2-fid or subentire. Capsule ovoid or oblong, 2- or 4-seeded below the middle. Seeds ovoid, compressed, usually hairy, retinacula curved, hardened. *DISTRIB.* Species 120; mostly tropical Asia and Africa.

Armed.

2-5 feet high; flowers yellow or orange; capsule 2-seeded ... 1. *B. Prionitis*.

Scarcely 1 foot high; flowers white; capsule 4-seeded ... 2. *B. acanthoides*.

Unarmed; flowers usually purplish-blue ... 3. *B. cristata*.

1. *BARLERIA PRIONITIS*, Linn. *Sp. Pl.* (1753) p. 636.—A shrub 2-5 feet high, much branched, usually armed with spines (modified bracts) which are straight, slender or flattened, sharp, pale-grey or whitish, solitary or in axillary fascicles of 2-4, usually about .5 inch long; stems terete or obscurely angular. Leaves very variable in size, usually about 4 by 1.5 inches, elliptic, acuminate at both ends, cuspidate, glabrous or more or less pubescent beneath especially when young, lineolate on the upper surface; lateral nerves about 5 pairs; the upper leaves smaller; petiole about .5 inch long, passing imperceptibly into the attenuated base of the leaf. Flowers 1 inch across, orange-yellow, solitary in the lower axils, becoming spicate above. Bracts .6-1 by .15-.4 inch, linear, oblong or elliptic-lanceolate, foliaceous, cuspidate; bracteoles .3-.5 inch long, spinous, or linear-subulate and sub-spinescent. Calyx cleft almost to the base; the outer lobes about .5 inch long, oblong-lanceolate, cuspidate; the inner smaller, linear-lanceolate, cuspidate. Corolla 1-1.5 inches long, pubescent outside; limb as long as the tube, somewhat 2-lipped, the upper lip of 4 oblong-obovate,

rounded lobes, the lower lip entire. Stamens 2 and 2 staminodes. Capsule .7-1 inch long, glabrous, ovoid, with a tapering solid beak, 2-seeded at the base.

Sub-Himalayan tract from the Ravi eastwards. Usually in hedges in rather dry sunny places. Likely to be found in the moister parts of the plains especially in the east of the Province. Flowers: October—March.

2. *BARLERIA ACANTHOIDES*, Vahl, *Symb. I* (1790) p. 47.—A small dense spiny undershrub scarcely 1 foot high; branches terete, hoary, pubescent. Leaves .5-1.5 inches long, oblong or obovate, obtuse, mucronate, pubescent, dark-green, base attenuated; lateral nerves about 5 pairs; petiole 0-.2 inch long. Flowers about .6 inch across, white, in unilateral condensed racemes often reduced to a single flower. Bracts .5-.7 inch long, appearing as flattened toothed more or less leaf-like or pinnatifid spines; bracteoles 0. Calyx cleft almost to the base; outer lobes subequal, .6 by .5 inch, ovate, conspicuously veined, sparsely hairy, entire or ciliate, soon turning yellowish-brown; inner lobes .3 by .1 inch, linear-oblong. Corolla 2.5-3.5 inches long, pure white, pubescent outside; tube cylindric, slightly funnel-shaped just below the top; lobes .3 inch long, ovate. Capsule .5 inch long, ellipsoid, narrowed at both ends, glabrous, 4-seeded.

Hills of the South Punjab. Very common on the hills in Rajputana. Flowers: October, opening at sunset according to stocks.

3. *BARLERIA CRISTATA*, Linn. *Sp. Pl.* (1753) p. 636.—An erect undershrub up to 3 feet high; twigs terete, canescent. Leaves very variable, 1-5 by .4-1.5 inches, oblong or elliptic-oblong, acute or acuminate at both ends, lineolate on both sides, the cystoliths slender curved or of 2 branches meeting at a wide angle, usually very inconspicuous beneath and often so above, more or less adpressed-hairy above and especially on the nerves beneath; lateral nerves 6-7 pairs; petiole .1-.5 inch long. Flowers .7-1 inch across, pale purplish-blue or pinkish, in axillary and terminal short spikes. Bracts 0; bracteoles .2-.5 inch long, linear-lanceolate, entire or with a few spinous teeth, mucronate. Calyx cleft nearly to the base; outer lobes .7-1 inch long, lanceolate, acuminate, mucronate, spinous-toothed, whitish, prominently veined and reticulate; inner lobes .3 inch long, linear-lanceolate, acute. Corolla 1-2 inches long, pubescent outside; tube about as long as the limb, broadly funnel-shaped in the upper part; lobes obovate-oblong. Stamens 2 and 2 staminodes. Capsule .6 inch long, ellipsoid, narrowed at both ends, glabrous, 4-seeded.

Sub-Himalayan tract ascending to 6,000 feet from the Indus eastwards. Common. Also Trans-Indus. Usually in hedges and open places. A white-flowered variety is sometimes grown in gardens as well as the common wild form. Flowers: July—October.

2. BLEPHARIS, Juss.

(From the Greek *blepharis*, an eyelash; referring to the fringed bracts
DISTRIB. Species 50; mostly African, a few species in India. Weedy under
shrubs, the following shrubby):—

BLEPHARIS SINDICA, T. Anders. in Journ. Linn. Soc. IX (1867) p. 500.—A small dichotomously branched shrub, stems usually short sometimes almost 0; branches ash-colored, rough with very short stiff hairs. Leaves sessile, in whorls of 4, unequal, 1·2·5 by ·06·2 inch, linear, acute, finely apiculate, sometimes with a few spinous teeth near the base, rough with very short stiff hairs, margins recurved, midrib prominent beneath. Flowers in strobiliform spikes, 3·4 by ·5·7 inch in fruit. subsessile in the forks of the branches, usually solitary in the upper forks and numerous in the lowest one. Bracts in 4 rows, ·5·1 by ·3·5 inch, ovate, abruptly acuminate, spinous-pointed, 5-nerved, the nerves and their branches ending in spinous teeth, both sides hairy; bracteoles 2, rather less than ·5 inch long, lanceolate, acute, hairy, ciliate, reticulate, midrib strong. Calyx 4-partite almost to the base, segments unequal; the anterior ·5 by ·25 inch, ovate, bluntly acuminate, the apex truncate, 7-nerved, the 3 central nerves parallel and 2 of them produced beyond the truncate densely ciliate apex into 2 bristly teeth, the middle nerve arrested below the margin; the posterior similar but broader and slightly longer, the nerves not produced into teeth; the two lateral ·3 inch long, ovate, bluntly acuminate, the solitary nerve produced beyond the truncate ciliate apex as a short bristle. Corolla ·3·5 inch long, the tube rigid, constricted below the limb; limb 2-lipped, the upper lip sub-obsolete, the lower 3-lobed, the middle lobe quadrate, truncate, twice as long and twice as broad as the rounded lateral lobes. Stamens 4, didynamous; filaments thick, rigid, those of the lower stamens produced beyond the attachment of their anthers; anthers with one large cell with densely bearded margins, the other cell small or obsolete. Disk annular. Ovary 2-celled; ovules 2 in each cell; style linear; stigma shortly 2-fid. Capsule ·3 by ·2 inch, ellipsoid, compressed, narrowed at both ends, glabrous, shining. Seeds sub-orbicular, compressed, densely clothed with thick hairs, retinacula rigid.

Plains of the Punjab. Hissar, Multan, Salt Range. A peculiar plant, the branches are prostrate and spread runner-like from the very short stem. Flowers: August—September.

3. DÆDALACANTHUS, T. Anders.

(From the Greek *daidalos*, curiously made, and *acantha*, a spine; referring to the bracts. DISTRIB. Species 13; India and Malaya.)

DÆDALACANTHUS NERVOSUS, *T. Anders. in Journ. Linn. Soc. IX* (1867) p. 487.—An erect undershrub 2-3 feet high. Leaves variable in size, about 6 by 3 inches, elliptic or ovate, acuminate, cuneately attenuated into the petiole, entire, glabrous or pubescent on the nerves, lineolate on both surfaces from embedded cystoliths; lateral nerves about 10 pairs, conspicuous, arcuate; petiole variable in length owing to the decurrent blade. Flowers .7 inch across, blue, in erect axillary and terminal dense spikes 1-3 inches long, spikes paniced or the axillary solitary. Bracts about .5 by .3 inch, foliaceous, obovate, cuspidate, glabrous or minutely pubescent, white with green veins. Bracteoles linear, acute, minutely pubescent, slightly shorter than the calyx. Calyx .25 inch long, minutely pubescent; lobes 5, linear-lanceolate, rather more than half as long as the tube. Corolla 1.2 inches long, glabrous, tube cylindric, narrow, widened near the top; limb oblique, spreading; lobes 5, subequal, twisted to the left in bud. Stamens 2, glabrous, anthers narrowly oblong, 2-celled, muticous, exserted. Ovary 2-celled, glabrous; ovules 2 in each cell; style long, nearly glabrous; stigma simple, linear. Capsule clavate, base cylindric, solid; seeds normally 4, on acute retinacula, compressed, discoid, elastically hairy when wetted.

Sub-Himalayan tract from the Indus eastwards ascending to 4,000 feet. Not very common. Usually in moist shady places. Easily recognized by its characteristic bracts. Often grown in gardens for its handsome flowers. Flowers: March—April.

4. *STROBILANTHES*, Blume.

(From the Greek *strobilos*, a fir-cone, and *anthos*, a flower; referring to the appearance of the young inflorescence in some species.)

Herbs, undershrubs or small shrubs. Leaves opposite, often unequal in the same pair, toothed or subentire, usually lineolate with cystoliths. Flowers solitary, in the axils of bracts, arranged in spikes or heads or in somewhat distant pairs, often forming terminal panicles. Bracts leaf-like or small, persistent or caducous; bracteoles linear or 0. Calyx deeply 5-fid; lobes narrow, often unequal, more or less accrescent in fruit. Corolla tubular, usually curved and ventricose, limb spreading; lobes 5, rounded, subequal, twisted to the left in bud. Stamens (in the Punjab species) 4, didynamous; anther-cells oblong, muticous. Disk small or elongated as a stalk to the ovary. Ovary 2-celled; ovules 2 in each cell; style linear; stigma of one long linear branch the other branch reduced to a minute lobe. Capsule compressed, oblong. Seeds 4, glabrous or hairy, compressed, retinacula strong curved. *DISTRIB.* Species about 200; mostly Asiatic.

In most floras all the *Strobilanthes* are described as shrubs but I have not found the Punjab species shrubby except *S. auriculatus*, *S. angustifrons* and *S. glutinosus*, the others have at most a few inches of the base of the stem persistent and more or less woody. All the Punjab species appear to flower annually, some of them are more or less gregarious and form an important constituent of forest undergrowth. *S. atropurpureus*, *S. alatus* and *S. Dalhousianus* are particularly common in the hills in association with balsams.

Bracts densely imbricate forming strobiliform spikes ... 1. *S. auriculatus*.

Bracts not imbricate.

Bracts persistent (see also No. 5 in which the lower bracts are persistent).

Flowers pale lilac; plant aromatic, viscous-hairy ... 2. *S. glutinosus*.

Flowers dark blue; plant usually nearly glabrous ... 3. *S. atropurpureus*.

Bracts deciduous (in No. 5 the lower persistent).

Upper leaves cordate; flowers in rather distant pairs ... 4. *S. alatus*.

Upper leaves narrowed at the base; spikes more or less head-like.

Bracts green, pubescent, acuminate ... 5. *S. angustifrons*.

Bracts white, glabrous, orbicular, concave 6. *S. Dalhousianus*.

1. *STROBILANTHES AURICULATUS*, Nees, in Wall. Pl. As. Kur. III (1882) pp. 69, 86, tab. 295.—An erect shrub, twigs glabrous, more or less quadrangular. Leaves very variable often unequal in the same pair, the larger up to 10 by 3 inches, oblong, acuminate, base usually much attenuated, auriculate, serrulate, thin, sparsely hairy and minutely but not closely lineolate above, paler beneath; lateral nerves 10-13 pairs, arcuate; the smaller about 3 by 1.1.5 inches, ovate or elliptic; petiole 0. Flowers .5 inch across, light bluish purple in dense strobiliform axillary and terminal spikes 3-4 inches long .5 inch across the bracts. Bracts .2-.3 inch long, obovate, obtuse or retuse, densely pubescent and ciliate with long white hairs, glandular; bracteoles 0. Calyx .2-.3 inch long, cleft nearly to the base; lobes ligulate, sub-acute, pubescent and ciliate with long white hairs. Corolla 1 inch long, nearly straight, puberulous outside, the cylindric portion much shorter than the ventricose, limb slightly 2-lipped. Stamens nearly glabrous. Capsule .3 inch long, glabrous. Seeds white-hairy.

Sub-Himalayan tract from the Bavi eastwards in moist shady ravines. Flowers annually: November—March.

2. *STROBILANTHES GLUTINOSUS*, Nees, in *Wall. Pl. As. Rar.* III (1832) p. 86.—A small shrub 2-3 feet high, viscous-hairy, aromatic. Leaves about 3 by 1·5 inches, elliptic, acuminate, base usually cuneate or narrowed, sometimes rounded, crenate-serrate, not lineolate, clothed above with rather stout soft hairs, hairy especially on the nerves beneath; lateral nerves 5-6 pairs, arcuate; petiole very variable in length, tomentose. Flowers 1·2-1·5 inches across, solitary in the axils of bract-like leaves or the upper in short capitate spikes. Bracts ·3 inch long, foliaceous, ovate, persistent; bracteoles ·2-·3 inch long, ligulate; both densely grey-hairy and viscid. Calyx ·3-·5 inch long, cleft nearly to the base; lobes linear, obtuse, viscous-hairy. Corolla 2 inches long, pale-lilac, tube linear-cylindric for ·5 inch then ventricose; lobes spreading, obcordate. Stamens glabrous. Capsule ·7 inch long, viscous-pubescent. Seeds ovate, shaggy.

Outer Himalaya 3-6,000 feet from the Indus eastwards. Easily recognized by its large flowers and season for flowering. Flowers annually. November--February.

3. *STROBILANTHES ATROPURPUREUS*, Nees, in *Wall. Pl. As. Rar.* III (1832) p. 86.—A perennial herb, stems thick and succulent or dwarfed, hirsute upwards, sometimes viscid, 4-grooved. Leaves usually about 3 by 1·5 inches, ovate or ovate-ranceolate, caudate-acuminate, base cuneately attenuated into the petiole, coarsely serrate, thin, membranous, sparsely pubescent with rather stout white hairs, minutely but usually very inconspicuously lineolate on the upper surface; lateral nerves 6 pairs of which the lowest 2-3 pairs arise close to the base petiole up to 3 inches long, the upper leaves and leaves in dwarf forms sessile. Flowers 1 inch across, dark-blue, in second pairs arranged in interrupted leafy spikes. Bracts persistent, leaf-like, from ·1 inch long of the upper flowers to 1 inch or more of the lower; bracteoles linear-oblong, small or 0. Calyx ·5-·6 inch long (1-1·3 inches long in fruit) cleft almost to the base, ligulate, subobtuse, patently hairy or nearly glabrous. Corolla 1·5 inches long, the cylindric portion shorter than the calyx, ventricose portion curved, broad, with scattered coarse hairs within, mouth oblique. Filaments hairy. Capsule ·8 inch long, glabrous. Seeds hairy. *S. Wallichii* var. *microphyllus*, Nees.

Temperate and subalpine Himalaya 6-12,000 feet, from the Indus eastwards. Common in moist places. Also Trans-Indus. Flowers during the rains.

This species is herbaceous and flowers annually, otherwise it is very similar to *S. Wallichii*, Nees (excl. var. *microphyllus*) from which it also differs in having more coarsely serrate leaves, broader sepals and larger end broader corollas. *S. Wallichii* has not been collected west of Jaunsar,

4. *STROBILANTHES ALATUS*, Nees, in DC. *Prodr.* XI (1847) p. 194.—A perennial herb with persistent woody base, stems more or less viscous-hairy, quadrangular. Leaves 3-6 by 1·7-3·3 inches, ovate, caudate-acuminate, base cordate or broadly rounded (rarely narrowed abruptly and confluent with the wings of the petiole), the upper leaves sessile and cordate, crenate-serrate, membranous, puberulous when young, glabrescent when mature, minutely lineolate on the upper surface, the cystoliths very inconspicuous on the paler lower surface; lateral nerves 7-8 pairs of which the lowest 3-4 pairs arise within ·5 inch from the base of the midrib; petiole 1-3 inches long, winged at least near the top. Flowers ·7 inch across, dark-blue, in interrupted viscous-hairy usually paniced spikes, which soon lengthen out so that the flowers are in distant pairs. Bracts narrow-lanceolate or oblong, the upper scarcely as long as the calyx, caducous; bracteoles ·2 inch long, narrowly oblong, caducous. Calyx ·3 inch long (·5-·8 inch long in fruit), cleft almost to the base; lobes ligulate, obtuse, glandular-hairy, one larger than the others. Corolla 1·5 inches long, the cylindric portion scarcely exceeding the calyx, ventricose portion curved, with 2 hairy lines within, mouth oblique. Stamens glabrous. Capsule ·7 inch long, glandular-hairy or nearly glabrous. Seeds shaggy.

Temperate Himalaya 6-10,000 feet, from the Indus eastwards, common. Also Trans-Indus. One of the commonest plants in forest undergrowth in the hills; varies somewhat in the amount of pubescence. Flowers annually, during the rains.

5. *STROBILANTHES ANGUSTIFRONS*, C. B. Clarke, in Hook. f. *Fl. Brit. Ind.* IV (1885) p. 466.—A perennial undershrub with persistent woody base, stems quadrangular, glabrous. Leaves 2-6 by ·8-3 inches, elliptic, elliptic-ovate or -lanceolate, acuminate at both ends, serrate, ciliate, somewhat scabrid towards the margin, lineolate on the upper surface, the cystoliths very numerous and minute, inconspicuous on the lower surface; lateral nerves 5-6 pairs arcuate; petiole 0·2 inches long, winged upwards. Flowers ·7 inch across, bluish-purple, in lateral and terminal panicleate spikes, the spikes often head-like, pedunculate, often with a pair of barren or floriferous foliaceous bracts about the middle of the peduncle. Bracts, the upper ·4 inch long, ovate, acuminate, pubescent, green, caducous; the lower when present foliaceous, narrowly lanceolate, persistent; bracteoles ·2 inch long, linear, caducous. Calyx ·3·5 inch long, deeply divided; lobes linear, sub-acute, pubescent. Corolla 1·5 inches long, nearly straight, the cylindric portion white, nearly as long as the ventricose, a hairy line above the adnate portion of the stamens. Stamens glabrous. Capsule ·3·5 inch long, sparsely pubescent. Seeds hairy.

Sub-Himalayan tract from the Ravi eastwards ascending to 6,000 feet in Kangra. Flowers annually, October-March. This species is found in moist shady places along ravines, etc. The inflorescence varies somewhat in appearance, sometimes the spikes are interrupted, the lower flowers being solitary in the axils of narrow leaf-like bracts. Often the lower bracts bear in their axils a pedunculate spike instead of a single flower. All the spikes have capitate tips so that when the lower solitary flowers of the interrupted spikes become replaced by spikes, the whole inflorescence becomes a panicle of capitate spikes. The plant reaches a height of 2-3 feet with a persistent stem of 1-2 feet, as thick as the finger. The corolla is minutely pubescent externally.

6. *STROBILANTHES DALHOUSIANUS*, C. B. Clarke, in Hook. f. *Fl. Brit. Ind.* IV (1885) p. 460.—A perennial herb with persistent woody base, stems hairy. Leaves 4-6 by 1·3-2 inches, elliptic (often narrowly), acuminate at both ends, serrate, minutely linedate on the upper surface, puberulous on the nerves on both sides; lateral nerves 6-7 pairs, arcuate; petiole 0·1 inch long. Flowers 5·5-7 inch across, dark-blue, in heads or very short pedunculate spikes. Bracts 2·3 inch long, orbicular, concave, whitened, glabrous, caducous; bracteoles (0, C. B. Clarke), similar to the bracts but smaller. Calyx 3 inch long, 5 inch long in fruit, glandular-pubescent or glabrate, cleft almost to the base; lobes ligulate, obtuse, one larger than the others. Corolla 1·5 inches long, widened gradually from near the base, curved. Stamens glabrous. Capsule 6 inch long, glandular-pubescent. Seeds silky. Collett, *Fl. Siml.*, fig. 118.

Himalaya 6,000-8,000 feet, from the Indus eastwards. Common in moist broad-leaved forests and sometimes more or less gregarious. Flowers annually during the rains.

S. pentstemonoides, T. Anders., is mentioned in Lace's list of plants of the Kangra District in Hart's Working Plan. I have seen no specimens of this species from west of Kumaon and Duthie only quotes Kanjilal for its occurrence west of Nepal.

The following are occasionally grown in gardens in the plains. Both are annually flowering shrubby plants.

STROBILANTHES SCABER, Nees.—Leaves elliptic or obovate, acuminate, usually very rough and hard. Flowers 7-1 inch long, yellow, in dense, often clustered spikes. Bracts 1 by 2 inch, lanceolate, hairy. Corolla very hairy within.

Indigenous to Bengal. Flowers: April.

STROBILANTHES ANISOPHYLLUS, T. Anders.—Leaves in very unequal pairs, one about 3·5 by 6 inch, the opposite leaf 1 by 1·5 inch, or smaller or obsolete when the leaves become pseudo-alternate, lanceolate, long-acuminate. Flowers 1 inch long, pale blue, in axillary 1-4-flowered heads. Bracts 2 inch long, elliptic, obtuse, nearly glabrous; bracteoles similar but smaller and narrower, both caducous.

Indigenous to the Kasia hills. *Strobilanthes isophyllus*, T. Anders., is a form with the leaves in equal pairs. Intermediates are common and the relative size of the leaves in the same pair is by no means constant on the same plant. Flowers: February-March.

5. *ÆCHMANTHERA*, Nees.

(From the Greek *aichmē*, the point of a spear, and *antheros*, flowering; referring to the minutely pointed connective in some species. **DISTRIB.** Species 2; Indian.)

ÆCHMANTHERA TOMENTOSA, Nees, in *Wall. Pl. As. Rar.* III (1832) p. 87.—An erect undershrub 1-3 feet high. Leaves 2-4 by 1-2 inches, ovate, sometimes oblong-lanceolate, acute, base rounded or rarely narrowed, crenate, densely but obscurely lineolate with cystoliths on the upper surface, pubescent above, pubescent or tomentose beneath; lateral nerves 8-14 pairs, much curved near the margin; petiole $\cdot 5\text{--}1\cdot 5$ inches long. Flowers $\cdot 5\text{--}7$ inch across, purple, in 3-8-flowered clusters, sessile on the spreading branches of an open terminal panicle. Bracts $\cdot 3\text{--}5$ inch long, linear-ligulate, as long as the calyx; bracteoles similar, smaller; both pubescent on the backs and ciliate, more or less viscid. Calyx $\cdot 3\text{--}5$ inch long, cleft almost to the base; lobes 5, linear-ligulate, pubescent on the backs, ciliate, more or less viscid. Corolla 1 inch long, tubular-ventricose, widened suddenly from below the middle, nearly straight, 2 hairy lines on the palate within, otherwise glabrous; lobes 5, subequal., rounded, twisted to the left in bud. Stamens 4, didynamous, included, longer filaments hairy, shorter glabrous; anther-cells muticous. Ovary 2-celled, densely hairy at the apex; ovules 4-6 in each cell; style sparsely hairy, thickened upwards; stigma linear, the outer lobe reduced to a minute tooth. Capsule linear, about as long as the calyx, 2-celled from the base. Seeds usually 8, discoid, densely hairy; retacula strong, hooked.

Var. WALLICHII. Stem and leaves beneath clothed with dense white woolly tomentum. Leaves thicker, rugose. Tip of the connective excurrent, re-curved.

Sub-Himalayan tract and Outer Himalaya 3,000-5,000 feet from the Ravi eastwards. Not uncommon in the undergrowth of forests of *Pinus longifolia*. Said to flower periodically at intervals of 4-5 years and to die after fruiting as do some *Strobilanthes*, but I am inclined to think that this is a mistake and that it flowers annually. It is apt to be mistaken for *Strobilanthes* but has more seeds. Flowers: August—October.

6. *PHLOGACANTHUS*, Nees.

(From the Greek *phlox*, *phlogos*, a flame, and *Acanthus*, a genus of this family. **DISTRIB.** Species 11; all Indian.)

PHLOGACANTHUS THYRSIFLORUS, Nees, in *Wall. Pl. As. Rar.* III (1832) p. 99.—An evergreen shrub 3-8 feet high; bark smooth grey, twigs quadrangular. Leaves opposite, 6-8 by $1\cdot 5\text{--}3$ inches, oblanceolate, oblong-oblanceolate or -elliptic, entire, acuminate, usually caudate, base cuneate, glabrous, soft, glossy deep-green above, glaucescent beneath; lateral nerves 7-10 pairs, arcuate; petiole $\cdot 7\text{--}1$ inch long. Flowers orange,

in dense spike-like panicles 4-12 inches long, spikes terminal, solitary or several, or quasi-axillary, rachis villous. Bracts .3-.5 inch long, linear, densely pubescent. Calyx densely pubescent; tube .1 inch long; lobes 5, linear-setaceous. Corolla .5-.8 inch long, villous; tube broad from the base, curved; limb oblique, the two upper lobes suberect, the three lower spreading, imbricate in bud. Stamens 2 and sometimes 2 rudimentary staminodes; anthers 2-celled, oblong, muticous. Ovary 2-celled; ovules 6-7 in each cell; style filiform, glabrous; stigma simple. Capsule 1-1.2 inches long, elongate, subquadrangular, valves deeply grooved on the backs, retinacula curved, hardened. Seed orbicular, compressed, hairy.

Sub-Himalayan tract from the Ravi eastwards. Rare, I have only seen it once near Pundwar, District Kangra. Moist shady ravines. Grown in gardens in the plains. Flowers: March—May.

7. ADHATODA, Nees.

(From the Tamil name *adhatodai*, what goats will not touch; referring to the leaves not being eaten by goats. DISTRIB. Species 8; throughout the tropics.)

ADHATODA VASICA, Nees, in Wall. Pl. As. Rar. III (1832) p. 103.—An evergreen gregarious shrub 4-8 feet high, foetid when bruised. Leaves 4-8 by 1.5-3 inches, elliptic or lanceolate, acuminate, base narrowed, minutely pubescent especially when young; lateral nerves 8-12 pairs; petiole .5-1 inch long. Flowers white, in short dense axillary pedunculate spikes 1-4 inches long; peduncles 1-4 inches long, stout. Bracts .4-.8 by .2-.5 inch, elliptic or obovate, sub-acute, green, minutely pubescent, 5-7-nerved; bracteoles about as long as the bracts, linear-ob lanceolate, acute, green, minutely pubescent, 1-nerved. Calyx .3-.5 inch long, cleft nearly to the base; lobes 5, oblong-lanceolate, equal, acute, glabrous or pubescent, 3-nerved. Corolla about 1 inch long, pubescent outside; tube .5 inch long, the lower half cylindric, the upper half much laterally inflated; limb 2-lipped, the upper lip hood-like, notched, the lower lip deeply 3-lobed, with 2 lines of oblique purple bars within. Stamens 2, inserted near the top of the corolla-tube; filaments stout, curved, hairy at the base; anthers 2-celled, one cell higher than the other, the lower cells minutely apiculate. Disk cupular. Ovary 2-celled, pubescent; ovules 2 in each cell; style filiform, subclavate above; stigma entire. Capsule 1 inch long, clavate, subacute, pubescent, the solid stalk .5 inch long, flattened; retinacula hard, curved. Seeds 4, glabrous, tubercled. Vern. *Baikar*, *basuti* (Ka), *bansha* (Bash.).

Sub-Himalayan tract ascending to 4,000 feet and in the less arid portion of the plains. One of the commonest shrubs in the Punjab especially in hedges, waste places, grazing grounds, etc. It undoubtedly owes its abundance to its

immunity from damage by goats and cattle. In some forests it is common as an undergrowth but chiefly on flat or gently sloping ground or on clay soils. Flowers: December—April.

8. LEPIDAGATHIS, Willd.

(From the Greek, *lepis*, *lepidos*, a scale and *agathis*, a ball; referring to the inflorescence in some species. DISTRIB. Species 80; in the warmer parts of the world, few in America.)

LEPIDAGATHIS CUSPIDATA, Nees, in Wall. *Pl. As. Rar.* III (1832) p. 97.—A suberect undershrub 1-3 feet high; stems pale-grey often nearly white and shining, woody, young shoots glandular-pubescent. Leaves variable, the lower 1·5-3 inches long, oblong, acuminate, mucronate, slightly pubescent, base cuneately tapering and decurrent into the petiole, entire; lateral nerves about 4-5 pairs, much upcurved; the upper leaves about ·7 inch long, elliptic, narrowed at both ends, glandular-pubescent, cuspidate, sessile, passing gradually into bracts. Flowers ·5-·6 inch long, white with purple spots, in terminal usually dense spikes 1-2 inches long, mostly borne on short lateral branches, spikes occasionally longer and laxer. Bracts ·4-·5 inch long, elliptic, narrowed at both ends, spinous-pointed, 3-nerved, densely glandular-pubescent. Bracteoles ·3 inch long, oblong-lanceolate, spinous-pointed, 1-nerved, glandular-pubescent like the bracts. Calyx ·5 inch long to the top of the longest segment, clothed with ascending silky hairs below, glandular-pubescent upwards; tube ·1 inch long; lobes 5, unequal, the upper outer lobe the largest, oblanceolate, 3-nerved, reticulate, the two lower shorter and narrower, the two lateral as long as the lower, linear, 1-nerved; all acute, spinous-pointed. Corolla pubescent outside, 2-lipped, the upper lip ovate, acute, entire or notched, the lower 3-lobed, the lobes rounded, the middle one the broadest. Stamens 4, didynamous; anthers 2-celled, bearded. Ovary 2-celled, glabrous; ovules 2 in each cell; style recurved, pubescent; stigma capitellate. Capsule ·3 inch long, ovoid-lanceolate, glabrous; seeds 4, supported on hard retinacula, ovoid, compressed, elastically hairy on the margins when wetted.

Sub-Himalayan tract and Outer Himalaya ascending to 5,000 feet from the Ravi eastwards. Pathankot, Dharamsala, Suket. A plant of hedges, dry rocky banks, etc. It is abundant in Dehra Dun. Flowers: December—March.

THUNBERGIA COCCINEA, Wall.—A large climber. Leaves 5-8 inches long, the lower ovate, the upper oblong. Flowers red to orange, in elongate pendent racemes. Bracts persistent; bracteoles ·5-1 inch long, ovate, often coherent on one side. Calyx a minute rim. Corolla 1 inch long 1·5 inches across.

Indigenous to the Central and Eastern Himalaya. Cultivated in Lahore. Flowers: December—March.

THUNBERGIA GRANDIFLORA, Roxb.—A large climber with swollen roots. Leaves 4-7 inches long, ovate, often angularly lobed, base cordate 5-7-nerved;

petiole 1-6 inches long. Flowers large, blue, in drooping racemes. Bracts deciduous. Calyx a small ring. Corolla 2-3 inches long and as much across.

Indigenous to Bengal. Cultivated in gardens in the plains. Flowers : May—August.

PETALIDIUM BARLERIODES, *Nees*.—A straggling shrub. Leaves 2-4 inches long, ovate, acuminate, toothed or crenulate. Flowers white, subsolitary or in decussate pairs in dense spikes. Stamens 4, didynamous. Capsule .5 inch long, 4-seeded.

Indigenous east of the Jumna and may be found wild in the Punjab. "Readily recognized by the large green-veined pairs of bracteoles, .7 inch long, strongly ribbed lower lip of corolla and the long fulvous hairs within it." (*Haines*.) Cultivated in Lahore.

ACANTHUS ILICIFOLIUS, *Linn.*—A sub-herbaceous shrub with tall erect stems. Easily recognized by its glossy, rigid, spinous-toothed leaves and large blue flowers in terminal bracteate spikes. Indigenous on the sea coasts of India, extending to Australia. Grown in gardens in the plains usually as an aquatic. Flowers : May—June.

APHELANDEA PECTINATA, *Willd.*—An evergreen shrub, 4 feet high. Leaves about 6 by 2.5 inches, elliptic, acuminate, base narrowed into a broadly winged petiole, pubescent especially on the nerves beneath. Flowers 1.5 inches long, scarlet, in dense terminal spikes. Bracts .5 inch long, elliptic, acuminate, with 2 black glandular patches at about the widest point, one on either side of the midrib. Corolla tubular, 2-lipped, upper lip erect, lower recurved. Stamens 4, anthers 1-celled.

Indigenous to South America. Grown in gardens in the plains.

JACOBINIA TINCTORIA, *Hemsl.*—An evergreen shrub, 4 feet high. Leaves variable in size, lanceolate, narrowed at both ends, slightly pubescent on the nerves beneath. Flowers 1.5 inches long, orange-red in axillary, unilateral, often branched spikes. Bracts small. Corolla tubular, 2-lipped, upper lip erect, lower recurved. Stamens 2, anthers 2-celled.

Indigenous to Central America. Cultivated in gardens in the plains. The plant yields indigo; hence the specific name.

JUSTICIA GENDARUSSA, *Linn. f.*—An evergreen shrub, 2-4 feet high. Leaves 4 by .7 inch, lanceolate. Flowers white or rose with purple spots, in spikes, spikes terminal and on short lateral branches. Bracts linear, shorter than the calyx. Corolla .5 inch long. Stamens 2, anthers 2-celled.

Wild in many parts of India, but possibly originally from China. Cultivated in gardens usually as an edging for paths. The foliage often has a purple hue. Flowers : April—May.

JUSTICIA VENTRICOSA, *Wall.*—A glabrous evergreen shrub, 3-4 feet high. Leaves 4-6 by 1.5-2 inches, elliptic, narrowed at both ends. Flowers .6 inch long, white, rose-spotted, usually in threes in the axils of bracts forming dense terminal spikes 2-3 inches long; bracts .3-5 inch long, orbicular, imbricate, much longer than the calyx. Stamens 2, anthers 2-celled.

Indigenous to Burma. Cultivated in Lahore. Flowers : February—March.

THYSACANTHUS STRICTUS, *Nees*.—An evergreen shrub. Leaves 8 by 2.5 inches, oblong, narrowed at both ends, lateral nerves strongly curved upwards near the margin and running for some distance close to it. Flowers 1.2 inches long, red, fascicled, the fascicles whorled, the whorls arranged in a terminal panicle. Bracts small. Corolla tubular in the lower half, ventricose above; limb subbilabiate .5 inch across. Stamens 2, included, anthers 2-celled.

Indigenous to Central America. Grown in gardens in the plains.

LXVIII. VERBENACEÆ.

Herbs, shrubs or trees. Leaves opposite or whorled, very rarely alternate, simple, rarely digitate, stipules 0. Inflorescence cymose, racemose or spicate; flowers zygomorphic or more or less actinomorphic, bi-sexual, rarely polygamous by abortion. Calyx inferior, gamosepalous, campanulate, tubular or cup-shaped, 4-5 (rarely 6-8)-lobed or -toothed. Corolla gamopetalous, tube usually cylindric or widened upwards, often curved; limb 2-lipped or sub-equally 4-5 (rarely more)-lobed. Stamens 4, didynamous, rarely equal, (rarely 2, very rarely isomerous with the corolla-lobes), anthers 2-celled, opening lengthwise. Ovary superior, 2-4 (rarely 8- or almost 1)-celled; ovules usually 2-1 in each cell, attached at the base or top of the cell or laterally; style terminal; stigma usually entire or 2-lobed. Fruit usually drupaceous, sometimes capsular. **DISTRIB.** A large family, mainly tropical.

- Leaves digitate ... 1. *Vitex*.
- Leaves simple.
 - Flowers in dense capitate or cylindric spikes ... 2. *Lantana*.
 - Flowers in cymose panicles.
 - Flowers regular; stamens isomerous, equal;
a woolly-tomentose shrub ... 3. *Callicarpa*.
 - Flowers 2-lipped or 4-5-lobed; stamens unequal.
 - Flowers large; 1 inch or more across; a tree ... 4. *Gmelina*.
 - Flowers usually less than 1 inch across.
 - Flowers very small; fruit with 1 pyrene ... 5. *Premna*.
 - Fruit with 4 pyrenes (normally) or capsular.
 - Fruit with 4 one-seeded pyrenes.
 - Calyx campanulate ... 6. *Clerodendron*.
 - Calyx broadly obconic ... 7. *Holmskioldia*.
 - Fruit breaking up into 4 valves with incurved margins holding the seeds ... 8. *Caryopteris*.

1. VITEX, Linn.

(The old Latin name used by Pliny for *Vitex Agnus-castus*. **DISTRIB.** Species about 60; all tropical and warm temperate regions.)

VITEX NEGUNDO, Linn. *Sp. Pl.* (1753) p. 638.—A large shrub, rarely a small tree, bark thin grey, branches whitish with fine tomentum. Leaves opposite, digitately 3-5-foliate;

petiole 1-2 inches long. Leaflets 2-6 by $\cdot 4\text{--}1\cdot 5$ inches, lanceolate, acuminate, entire, crenate or coarsely serrate, nearly glabrous above, covered with fine white tomentum beneath, the terminal the largest on a petiolule $\cdot 4\text{--}5$ inch long, the lateral smaller with shorter petiolules or subsessile. Flowers about $\cdot 2$ inch across, blue or lavender, in opposite cymes arranged in an elongated terminal thyrsus, which is often branched at the base; bracts $\cdot 07\text{--}1$ inch long, lanceolate, caducous. Calyx $\cdot 1\text{--}15$ inch long, campanulate, white-tomentose; teeth 5, minute, triangular. Corolla $\cdot 3$ inch long, tomentose outside, hairy at the insertion of the stamens, tube short, limb 2-lipped, upper lip deeply 2-lobed, lower lip 3-lobed, the middle lobe obovate, crenulate, larger than the oblong obtuse lateral lobes. Stamens 4, didynamous, exserted; anther-cells at first parallel and pendulous, afterwards divaricate. Ovary 4-celled; ovules 1 in each cell, attached near the top of the cell; style filiform; stigma bifid. Fruit $\cdot 2$ inch diameter, black, exocarp succulent; endocarp bony, 4 (or by abortion fewer)-celled. Vern. *marwan* (Haz.), *bana* (Ka).

Sub-Himalayan tract ascending to 4,000 feet from the Indus eastwards. Also Trans-Indus. Common. Often gregarious in small patches on the banks of streams and similar places. Grows readily from cuttings, and is often planted in hedges by natives. Young leafy shoots, planted nearly horizontally in the rains, appear to root better than older wood. The plant is likely to be useful for afforestation works, but not in very dry places. The form with more ovate-lanceolate coarsely serrated leaves is var. *incisa* (sp. Lamk.); it passes into the typical form, and both kinds of foliage may sometimes be found on the same plant. Flowers: March—June.

2. LANTANA, Linn.

(The old Italian name for the wayfaring tree, *Viburnum Lantana*; applied to this genus on account of resemblances in foliage, flowers and fruits.)

Rambling or erect shrubs or herbs; branches quadrangular, often prickly. Leaves opposite or ternate, simple, crenate, often rugose. Flowers in pedunculate, capitate, ovoid or cylindric spikes; bracts conspicuous, longer than the calyx; bracteoles 0. Calyx small, membranous, truncate or obscurely 4-5-toothed. Corolla-tube slender, cylindric; limb regular or obscurely 2-lipped, 4-5-lobed, spreading. Stamens 4, didynamous, inserted about the middle of the corolla-tube, included; anthers broadly oblong. Ovary 2-celled; ovules 1 in each cell, erect from the base or attached laterally near the base of the cell; style short; stigma oblique, thickened. Fruit drupaceous, with a more or less fleshy mesocarp; endocarp hard, separating when ripe into two 1-celled, 1-seeded pyrenes. **DISTRIB.** Species about 50; mostly in tropical America.

Flower-heads ovoid, becoming oblong; bracts
ovate; stems not prickly

... 1. *L. indica*.

Flower-heads permanently capitate; bracts lanceolate; stem usually prickly ... 2. *T. Camara*.

1. *LANTANA INDICA*, Roxb. *Hort. Beng.* (1814) p. 46.—An erect shrub usually 2-3 feet high; twigs not prickly, densely hairy upwards. Leaves opposite, 1-3 by 4-1·7 inches, ovate, rather variable, usually very rugose above and with prominent veins beneath, subacute, base rounded or narrowed, crenate-serrate, finely pubescent or more or less scabrid above, dotted beneath with numerous minute glands which are usually more or less completely obscured by dense soft pubescence; petiole 1-3 inch long. Flower 2 inch across, white, in ovoid heads which lengthen and become oblong as flowering proceeds and reach 1-1·5 inches long in fruit; peduncles 1-3 inches long, slender, quadrangular, hairy; bracts ovate, acuminate, softly hairy on both sides, the lower 25 inch long, the upper smaller. Calyx about 05 inch long, truncate, hairy. Corolla-tube about 25 inch long, hairy outside; lobes 4, rounded. Fruit 15-2 inch diameter, purple.

Sub-Himalayan tract and adjacent plains from the Indus eastwards, ascending to 3,000 feet. Salt Range. In rather dry places; not very common. Specimens from moister localities have the leaves less rugose, less hairy beneath and larger than those from dry places. The flowers are said to be light-purple with a yellowish tube, but I have always seen them pure white and the notes on the sheets in Dehra say "flowers white." The flowers appear more or less all the year round. Baker in the *Flora of Tropical Africa* unites this with *L. salvifolia*, Jacq., a South African species

2. *LANTANA CAMARA*, Linn. *Sp. Pl.* (1753) p. 627.—A large scrambling evergreen shrub, 4-8 feet high; twigs usually more or less prickly, pubescent, prickles when present hooked. Leaves opposite, 1-3 by 6-1·7 inches, ovate, subacute, base truncate or narrowed, crenate-serrate, scabrid on both sides; petiole 2-5 inch long. Flowers 25 inch across, usually orange, in heads which are permanently capitate, 1 inch across; peduncles 1-3 inches long, hispid, thickened upwards; bracts 25 inch long, lanceolate, hispid. Calyx about 08 inch long. Corolla-tube 8-5 inch long, slender, pubescent; lobes 4, rounded. Fruit 2 inch diameter, black, shining. *L. aculeata*, Linn. Vern. *panchphuli* (Madhopur).

Indigenous to tropical America and completely naturalized in many parts of India. It has obtained a footing near Madhopur, Chamba and Sabathu and is often seen in hedges in the Palampur Tahsil, Kangra District, and in Hoshiarpur. The plant has become a pest in parts of the Deccan and much has been written against it. In places which suit it, it grows in dense impenetrable masses. If it could be got to grow in the Hoshiarpur Siwaliks or in the sheltered ravines of the Pabbi Hills, it would be very useful. In cultivated plants flowers of all colors from cream to yellow, crimson and purple, are found, and the color is frequently variable in the same head. Flowers more or less throughout the year.

3. *CALLICARPA*, Linn.

(From the Greek *kallos*, beauty, and *karpos*, fruit. *DISTRIB.* Species 30; tropical and subtropical regions, excluding Africa and South America.)

CALLICARPA MACROPHYLLA, *Vahl, Symb. III (1794) p. 13, t. 53.*—An erect evergreen shrub, 4-8 feet high, twigs, petioles, peduncles and leaves beneath densely woolly-tomentose. Leaves opposite, 4-10 by 1-4 inches, ovate-lanceolate or oblong-lanceolate, acuminate, crenate, clothed above when young with stellate pubescence ultimately glabrescent, densely grey woolly-tomentose beneath, lateral nerves 10-15 pairs, prominent beneath; petiole .3-.6 inch long, stout. Flowers .1 inch across, pink, in many-flowered axillary dichotomous cymes 1.5-3 inches across; peduncles .5-1 inch long. Calyx .05 inch long, campanulate, minutely 4-lobed. Corolla .1 inch long; tube short, cylindric; limb 4-lobed, spreading, subsymmetrical. Stamens 4, equal, inserted in the upper half of the corolla-tube, exserted, anthers small, ovate. Ovary 4-celled; ovules 1 in each cell, inserted above the middle of the cell; style linear; stigma dilated, obscurely 2-fid. Fruit .15 inch diameter, white, succulent, endocarp hard, breaking up into 4 (or by abortion fewer) pyrenes.

Sub-Himalayan tract from the Indus eastwards ascending to 4,000 feet. Fairly common in waste places along ravines, etc. Flowers during the rainy season.

The two following species are occasionally seen in gardens in North India. They resemble *C. macrophylla* and can easily be mistaken for that species:—

CALLICARPA REEVESII, *Wall.*—A small shrubby tree. Cymes rather lax (for the genus); peduncles 1.5-2.5 inches long. Otherwise as for *C. macrophylla*.

Native of China. Has long been cultivated in gardens in India, e.g., Lahore.

CALLICARPA LONGIFOLIA, *Lamk.*—A large much-branched shrub. Leaves sparsely stellate beneath and closely dotted with minute yellow glands. Otherwise as for *C. macrophylla*.

Native of Eastern Bengal and the Khasia Hills. Has long been cultivated in gardens.

4. *GMELINA*, Linn.

(In honor of S. Gottlieb Gmelin, a celebrated German naturalist and traveller of the 18th century. *DISTRIB.* Species 8; S. E. Asia and Australia.)

GMELINA ARBOREA, *Roxb. Hort. Beng. (1814) p. 46.*—A medium-sized to large deciduous tree, bark smooth, greyish. Leaves opposite, 4-8 by 3-6 inches, broadly ovate, acuminate, entire, glabrous above when mature, pale and finely mealy-tomentose beneath; base usually truncate, but with a short

cuneate attenuation at the top of the petiole ; lateral nerves 6-10 pairs, the lowest pair sub-basal ; petiole 2-6 inches long, glandular at the top. Flowers about 1 inch across, reddish or brown and yellow, appearing with the young leaves and arranged decussately in cymes of 1-3 flowers along the branches of hairy lateral and terminal panicles up to 12 inches long ; bracts .3 inch long, linear-lanceolate. Calyx .2 inch long, broadly campanulate, densely fulvous-hairy ; teeth 5, small, triangular, acute. Corolla 1-1.5 inches long, tubular below, throat obliquely funnel-shaped ; limb 2-lipped, the upper lip deeply divided into two oblong obtuse lobes, the lower lip about twice as long as the upper, 3-lobed, the middle lobe much longer than the lateral ones and with a crenulate margin. Stamens 4, didynamous ; anthers oblong, the cells separate, parallel. Ovary 4-celled ; ovules 1 in each cell, attached near the top of the cell ; style slender ; stigma shortly 2-fid. Fruit .7-1 inch long, ob-ovoid, seated on the unenlarged calyx, exocarp succulent, endocarp bony, usually 2-celled. Vern. *kumhâr*, *gumhâr*.

Sub-Himalayan tract from the Ravi eastwards. Not common. Often cultivated in the plains. The wood is valuable ; it is white or yellowish, even-grained, easily worked, does not warp or shrink, and is durable. The growth is fast, about four rings per inch of radius, and the tree is easily grown from seed. Young plants are hardy against frost and drought. The tree would be worth experimental cultivation for timber in irrigated plantations. There are a few trees in Changa Manga which show that they can stand the conditions of an irrigated plantation, but as they are not in the coupes, they do not afford an idea as to how they would do as standards. The tree is apt to grow crooked, so that it may not be suitable for uneven-aged crops. The leaves of young plants are often coarsely toothed. Reproduces well from the coppice. Flowers : March—April.

5. *PREMNA*, Linn.

(From the Greek *premon*, the stump of a tree ; referring to the low stem of most species.)

Trees or shrubs, rarely undershrubs, sometimes climbing. Leaves opposite or in whorls of three, entire or toothed. Flowers small, greenish or white, in paniced or corymbose cymes. Calyx small, campanulate, truncate, 2-lobed or 3-5-toothed. Corolla with short cylindric tube, throat often bearded, limb spreading, 2-lipped, 5-lobed or sub-equally 4-lobed. Stamens 4, didynamous, inserted below the throat of the corolla, usually shorter than its lobes ; anthers ovate or rounded ; cells parallel or divergent. Ovary 2- or 4-celled ; ovules 4, inserted near the top of the cells ; style linear ; stigma shortly 2-fid. Fruit small, seated on the calyx, exocarp succulent, often thin, endocarp hard undivided, 4 (or by abortion fewer)-celled with a central cavity. **DISTRIB.** Species 40 ; warmer regions of the old world.

Large shrubs or trees ; leaves petiolate.

Calyx 5-toothed, much enlarged in fruit ... 1 *P. mucronata*.

Calyx 4-toothed, not enlarged in fruit ... 2 *P. barbata*.

An almost stemless undershrub, leaves sessile ... 3 *P. herbacea*.

1. *PREMNA MUCRONATA*, *Roxb. Fl. Ind. III* (1832) p. 80.—A small or medium-sized deciduous tree, bark greyish-white. Leaves opposite or occasionally ternate, 3-5 by 1·5-3 inches, ovate, acuminate, base cuneate, usually entire, drying black, glabrous above when mature, softly pubescent especially on the nerves beneath ; lateral nerves 4-6 pairs ; petiole ·3-·5 inch long. Flowers ·1 inch across, greenish, in terminal corymbose pubescent trichotomous panicles. Calyx ·07 inch long, pubescent, shortly 5-toothed. Corolla ·15 inch long, pubescent. Fruit ·2 inch diameter, globose, black, half enclosed by the accrescent cup-shaped calyx. *P. latifolia*, *Roxb. var. mucronata*. *Fl. Brit. Ind.*, IV, p. 578. Vern. *gîn, bhankâr*.

Sub-Himalayan tract and adjacent moist parts of the plains from the Ravi eastwards, not very common. Wood hard, a good fuel. Flowers : April—June.

2. *PREMNA BARBATA*, *Wall. Cat.* (1828) No. 1768.—A small deciduous tree, bark dark-grey. Leaves opposite, 3-7 by 1·5-4 inches, ovate, acuminate, base usually truncate or broadly cuneate, usually toothed especially towards the apex, drying green, puberulous on both surfaces when young, glabrous or nearly so when mature, lateral nerves 4-6 pairs, the lowest from the base ; petiole ·6-2 inches long, channelled above. Flowers ·15 inch across, greenish, in terminal corymbose pubescent trichotomous panicles. Calyx ·07 inch long, pubescent, rather deeply sub-equally 4-lobed. Corolla ·15-·2 inch long, the throat bearded within. Fruit ·2 inch diameter, globose, seated on the unenlarged calyx, stone verrucose. Vern. *ganhîla*.

Sub-Himalayan tract and outer Himalaya, ascending to 4,000 feet, from the Indus eastwards. Rare west of the Ravi. In the absence of flowers or fruits this is best distinguished for *P. mucronata* by its longer channelled petioles. Flowers : April—May.

3. *PREMNA HERBACEA*, *Roxb. Hort. Beng.* (1814) p. 46.—A small almost stemless undershrub. Stems annual, 1-4 inches long. Leaves in rosettes of 2 or 3 pairs, 1-5 inches long, obovate, obtuse, base cuneate, coarsely serrate, sessile, puberulous on the nerves above, pubescent beneath. Flowers ·1 inch across, pale-yellow or greenish, in terminal corymbose pubescent trichotomous panicles. Calyx ·1 inch long, cup-shaped, pubescent, sub-equally 5-lobed. Corolla ·2 inch long, throat hairy, limb 4-lobed, obscurely 2-lipped. Fruit ·25 inch diameter, globose, black, seated on the slightly enlarged calyx.

Sub-Himalayan tract from Kashmir eastwards (*Brandis*). I have seen no Punjab specimens. A plant of stiff soils in open grassy places. This is a plant supposed to have been permanently dwarfed by periodic jungle fires as *Grewia sapida*. Flowers : February—May.

6. CLERODENDRON, Linn.

(From the Greek *kleros*, chance, and *dendron*, a tree; referring to medicinal properties, *C. fortunatum* being supposed to be beneficial and *C. calamitosum*, *C. infortunatum* etc., injurious.)

Undershrubs, shrubs or small trees. Leaves opposite or whorled, simple, entire, toothed or lobed. Flowers in axillary cymes or terminal panicles, often leafy below; bracts small or conspicuous. Calyx campanulate, rarely tubular, truncate, 5-toothed or partite, persistent, often accrescent and colored. Corolla-tube narrowly cylindric, straight or curved, often very long; limb more or less oblique with 5 spreading lobes. Stamens 4, didynamous, much exserted; anthers ovate or oblong, the cells parallel. Ovary incompletely 4-celled; ovules 1 in each cell, attached near the top of the cell; style long, filiform; stigma shortly 2-fid. Fruit usually 4-furrowed or -lobed, exocarp more or less succulent, endocarp crustaceous or bony, dividing into 4 one-seeded or 2 two-seeded stones. **DISTRIB.** Species about 100; mainly in warm regions of the old world.

Leaves opposite (often whorled in *C. serratum*); stems solid.

Calyx not or scarcely enlarged in fruit.

Calyx-lobes long; leaves less than 3 inches long 1. *C. Phlomidis*.

Calyx-lobes short; leaves often 6 inches long or more 2. *C. serratum*.

Calyx much enlarged and turning red in fruit 3. *C. infortunatum*.

Leaves whorled; stems hollow 4. *C. Siphonanthus*.

1. CLERODENDRON PHLOMIDIS, Linn. f. *Suppl.* (1781) p. 292.—A shrub or small tree, bark thin, smooth, twigs grey-pubescent. Leave opposite, 1-2·5 by ·8-1·5 inches, ovate or sub-rhomboid, acute or obtuse, base truncate or obtuse, entire, undulate or coarsely crenate-dentate, more or less puberulous on both surfaces, dull-green; lateral nerves 3-5 pairs, the lowest pair sub-basal; petiole ·3-·7 inch long. Flowers ·6 inch across, white or pinkish, fragrant, in small axillary dichotomous cymes forming a rounded terminal panicle; bracts ·2 inch long, lanceolate or obovate, foliaceous. Calyx ·4 inch long, divided about half-way down, glabrous or puberulous, slightly enlarged in fruit, lobes ovate-acuminate. Corolla-tube ·8 inch long, slightly pubescent outside; lobes ·25 inch long, elliptic, obtuse. Fruit ·25 inch across, broadly obovoid, black when ripe. *C. phlomoides*, Willd., et Auct. Pl.

Not common in the Punjab, but is found in the Salt Range; on the Ridge at Delhi; Hissar; Changa Manga. Flowers: August—February.

2. *CLERODENDRON SERRATUM*, *Spreng. Syst. Veg.* II (1825) p. 758.—An erect undershrub 3-5 feet high, sending up straight unbranched shoots from a stout woody root-stock. Leaves opposite or ternate, usually about 6 by 1·7 inches, but reaching 12 by 4 inches, oblong, obovate-oblong or elliptic-oblong, acute, coarsely sharply and rather distantly serrate, glabrous except when quite young; lateral nerves 8 pairs, curving near the margin and running for some distance close to it; petiole 0·1 inch long. Flowers about ·6 inch across, bluish, in pubescent dichotomous cymes in the axils of the upper leaves, forming a long terminal panicle; bracts ·5 inch long, linear-lanceolate, acuminate. Calyx ·2 inch long, cup-shaped, puberulous, scarcely enlarged in fruit; lobes minute, triangular. Corolla-tube ·3 inch long, cylindric, hairy within, oblique at the mouth; the two upper and two lateral lobes elliptic, obtuse, flat, spreading; the lower lobe (often appearing upper in flower by the twisting of the pedicel) larger, ·5 inch long, concave, darker in color than the other lobes. Style and filaments much curved. Fruit ·3 inch across, broadly obovoid, dark-purple when ripe.

Valleys in the Himalaya ascending to 4,000 feet; Kulu; Sutlej valley near Rampur. A shrub of open grassy hillsides; not common. Probably also occurs in the Sub-Himalayan tract. "The stems do not always die down and it is then an irregularly branched shrub with smaller fleshy leaves" (*Haines*). Flowers: May—August.

3. *CLERODENDRON INFORTUNATUM*, *Linn. Sp. Pl.* (1758) p. 637.—A shrub usually 3-5 feet high, branches rough with very large corky lenticels, twigs hairy. Leaves opposite, 4-10 by 3·5-8 inches, ovate, shortly acuminate, base broadly rounded or subcordate, denticulate, roughly pubescent on both sides or almost tomentose beneath; lateral nerves about 6 pairs, prominent beneath; petiole 1-6 inches long. Flowers ·7-1 inch across, white tinged with red, in large lax terminal pubescent panicles; bracts ·5-1 inch long, foliaceous, deciduous. Calyx ·5 inch long, 5-partite, silky-pubescent, much enlarged coriaceous and red in fruit; lobes broadly lanceolate, very acute. Corolla densely pubescent outside; tube ·7 inch long, slender; lobes 3·5 inch long, elliptic or oblong, obtuse. Fruit ·3 inch diameter, subglobose, black when ripe, seated on the enlarged coriaceous red calyx.

Sub-Himalayan tract from the Beas eastwards (*E. M. Coventry*). I have seen no wild Punjab specimens, but the plant is abundant east of the Jumna in forest undergrowth, under mango trees, etc. Spreads readily by root-suckers. Cultivated in gardens in the plains. Flowers: January—April.

4. *CLERODENDRON SIPHONANTHUS*, *R. Br. in Ait. Hort. Kew. ed. 2 IV* (1812) p. 65.—A tall erect little-branched shrub 4-12 feet high; stems herbaceous, fluted, hollow. Leaves in whorls of 3-5, 6-9 by 1-1·5 inches, oblong, shortly acuminate, base narrowed, entire or sinuate, glabrous; lateral nerves about 8 pairs, strongly curved and anastomosing near the margin; petiole 0. Flowers ·7 inch across, 3-4 inches long, white, in lax usually 3-flowered cymes in the axils of the upper leaves forming a long terminal panicle; bracts 1-1·5 inch long, linear. Calyx 3-5 inch long, cleft half-way down, lobes oblong or ovate, acute. Corolla-tube 3-4 inches long, curved, very slender; lobes ·5 inch long, ovate-oblong. Fruit ·5 inch across, dark bluish-green when ripe, seated on the enlarged red calyx.

Sub-Himalayan tract from the Beas eastwards. Has been collected in the lower hills of the Hoshiarpur District. Frequently cultivated in gardens. Flowers: July–August.

Several species are grown in gardens in the plains and Sub-Himalayan tract.

A.—Flowers double.

CLERODENDRON FRAGRANS, *R. Br.*—A shrub 2-8 feet high. Leaves opposite, 4-8 inches long and nearly as broad, ovate, acute or shortly acuminate, base truncate, but usually cuneately attenuate near the top of the petiole, undulate or coarsely irregularly serrate-dentate, pubescent on both surfaces especially when young, a few large glands near the top of the petiole; lateral nerves 4 pairs, the lowest pair basal; petiole 2-6 inches long. Flowers 1 inch across, white slightly tinged with pink, fragrant, in compact terminal corymbose panicles 3-4 inches across. Calyx 5-7 inch long, cleft nearly half-way down, lobes ovate-lanceolate, acuminate. Corolla double, tube shorter than the calyx.

Indigenous to China. Cultivated in gardens in the plains and in the lower Himalaya and Sub-Himalayan tract. Spreads readily by root-suckers often considerably beyond the area in which it was planted. Likes moist shady places. It is becoming common in the Kangra District.

B.—Flowers single.

I.—A spiny shrub.

CLERODENDRON ACULEATUM, *Griesb.*—A shrub 5-10 feet high, base of the petiole persisting after the fall of the leaves as a short conical somewhat recurved spine. Leaves opposite, 1-2 by 5-9 inch, elliptic, narrowed at both ends; petiole 2-4 inch long, slender except near the base. Flowers 4 inch across, white, in few-flowered lax axillary cymes crowded towards the ends of the branches. Calyx 1·5 inch long, pubescent, lobed nearly half-way down; lobes ovate, acute. Corolla-tube 7 inch long, very slender. Stamens and style much exerted.

Indigenous to tropical America. Cultivated in gardens in the plains. Is a useful hedge plant, but is seldom used as such.

II.—Unarmed shrubs.

CLERODENDRON INERME, *Gærtn.*—A rambling evergreen shrub. Leaves opposite, 1-2 by 7-13 inches, elliptic or obovate, obtuse, entire, glabrous or

nearly so, base narrowed; petiole .2-4 inch long. Flowers .6-8 inch across, white, in axillary pedunculate usually 3-flowered cymes. Calyx .2 inch long, teeth minute. Corolla-tube 1-1.3 inches long, slender, glabrous without hairy within. Stamens and style much exserted, crimson.

Indigenous on the sea-coasts of India. Often grown in gardens for covering banks, walls, etc. A very hardy and quick-growing shrub which might perhaps be useful for afforestation work.

CLERODENDRON GLABRUM, *E. Mey.*—An erect shrub or small tree 4-15 feet high. Leaves opposite or whorled, 3-4 by 1.5-2 inches, ovate, acute, cuneately attenuate near the base, entire, subcoriaceous, glabrous, shining above, paler and closely dotted with minute glands beneath; petiole .5 inch long. Flowers .3 inch across, white, in many-flowered, corymbose, terminal panicles. Calyx .1-1.5 inch long; lobes acute, nearly as long as the tube. Corolla finely puberulous and glandular, tube .3 inch long; lobes subequal.

Indigenous to tropical and South Africa. Occasionally grown in gardens in the plains. This plant has much the appearance of a *Ligustrum*.

CLERODENDRON HETEROPHYLLUM, *R. Br.*—An erect shrub. Leaves opposite, 1.5-2 by .5-7 inch, lanceolate, narrowed at both ends; petiole .2-3 inch long, slender, jointed on to a swollen conical base. Flowers .6 inch across, white, in axillary few-flowered cymes; peduncles and pedicels slender, hoary-puberulous. Calyx nearly .15 inch long, campanulate; teeth 5, minute. Corolla .7 inch long, tube slender; lobes obovate-oblong, equalling the tube.

Indigenous to the Mascarenes. Occasionally grown in gardens in the plains.

7. HOLMSKIOLDIA, Retz.

(In honor of Theodor Holmskiöld, a Danish botanist of the 18th century. *DISTRIB.* Species 4; Himalaya, Africa and Madagascar.)

HOLMSKIOLDIA SANGUINEA, *Retz. Obs. fasc. 6 (1791) p. 31.*—A large straggling shrub, twigs sharply quadrangular, pubescent when young. Leaves opposite, 3-4 by 2-3 inches, ovate, acuminate, base truncate or subcordate, subentire, crenate or crenate-serrate, puberulous and dotted with minute glands on both surfaces, but especially on the lower; lateral nerves 5 pairs, the lowest pair from the base; petiole .5-1 inch long. Flowers .3 inch across, bright-red, in short axillary cymes; bracts .1-2 inch long, obovate or spatulate, viscous-pubescent, deciduous. Calyx .5 inch across, broadly obconic, subtruncate, scarlet tinged with orange; in fruit 1 inch across, membranous, reticulate, bright-red. Corolla .7-1 inch long; tube curved, somewhat widened upwards; limb oblique, 5-lobed, obscurely 2-lipped, lobes small, unequal, the lowest the longest. Stamens 4, didynamous, exserted; anthers ovate, the cells parallel. Ovary 4-celled; ovules 1 in each cell, attached laterally; style long; stigma very shortly 2-fid. Fruit .2-3 inch long, obovoid, deeply 4-lobed at the apex, nearly dry, endocarp splitting into 4 pyrenes.

Sub-Himalayan tract and outer Himalaya from the Beas eastwards. Not common. Often cultivated in gardens. Flowers: October—December.

8. CARYOPTERIS, Bunge.

(From the Greek *karyon*, a nut, and *pteron*, a wing; referring to the incurved edges of the valves of the capsule.)

Erect or rambling shrubs. Leaves opposite, toothed or subentire, acuminate, minutely dotted with glistening yellow glands. Flowers in small dense many-flowered axillary cymes or forming a terminal thyrsus. Calyx campanulate, deeply 5-fid, slightly enlarged in fruit. Corolla with short cylindric tube; limb spreading, 2-lipped, middle lobe of the lower lip the largest crisped or fimbriate. Stamens 4, didynamous, exserted; anther-cells (in the following species) confluent. Ovary incompletely 4-celled; ovules 1 in each cell, attached laterally; style filiform; stigma shortly bifid. Capsule small, globose, dividing into 4 concave valves with incurved margins holding the seeds. DISTRIB. Species 5; 3 Indian, 2 Chino-Japanese.

Cymes usually forming a terminal thyrsus; calyx-lobes in fruit lanceolate, erect ... 1. *C. Wallichiana*.

Cymes mostly axillary; calyx-lobes in fruit triangular, spreading ... 2. *C. grata*.

1. *CARYOPTERIS WALLICHIANA*, Schauer, in *DC. Prodr.* XI (1847) p. 625.—An erect shrub 4-12 feet high, twigs pubescent, marked with a raised line at the nodes. Leaves 1·5-4 by ·6-1·2 inches, elliptic or lanceolate, acuminate, usually crenate-serrate, canescent; petiole ·3-·5 inch long. Flowers ·5 inch across, blue or purple (or sometimes white in cultivation), sweet-scented, in compact pubescent cymes usually forming a terminal thyrsus; bracts ·1 inch long, linear, acute, pubescent. Calyx ·15-·2 inch long in flower, pubescent, cleft more than half-way down; ·3 inch long with erect 3-nerved segments in fruit. Corolla-tube ·3 inch long; limb ·5 inch across, the largest lobe ·3 inch long, obcordate, darker in color than the rest. Capsule ·2 inch diameter, densely pubescent, dark-blue when ripe. Collett, *Fl. Siml.*, fig. 121.

Sub-Himalayan tract and outer Himalaya from the Indus eastwards. Common. Ascends to 5,000 feet. Sometimes grown in gardens. Flowers: February—April.

2. *CARYOPTERIS GRATA*, Benth. in *Gen. Pl.* II (1876) p. 1158.—A rambling shrub, twigs densely pubescent, brown or purple. Leaves 2-5 by ·8-1·5 inches, elliptic or oblong-lanceolate, acuminate, crenate-serrate or subentire, puberulous above, pubescent or almost villous beneath; petiole ·3-·6 inch long. Flowers ·2 inch across, white or purplish, in densely pubescent axillary cymes less than 1 inch long; bracts ·1 inch long, subulate, densely pubescent. Calyx ·1-1·5 inch long in flower, densely pubescent, cleft nearly half-way down; in fruit scarcely enlarged, with spreading triangular lobes. Corolla-tube ·15 inch long; limb ·2 inch across, the largest lobe ·15 inch long, notched at the tip. Capsule ·15-·2 inch diameter, glabrous, red when ripe.

Sub-Himalayan tract and outer Himalaya 4,000-5,500 feet. Common in the Rawalpindi Hills. Has not been collected between the Jhelum and the Jumna as yet and should be looked for. Flowers: February—May.

LIPPIA CITRIODORA, *H. B. & K.*—A shrub. Leaves ternate, 2-3 inches long, lanceolate or oblong-lanceolate, sweetly aromatic. Flowers 2 inch across, whitish or lilac, in terminal panicles. Calyx tubular, teeth 4, triangular, small. Corolla-tube cylindric, short, limb 4-lobed, slightly 2-lipped. Stamens 4, didynamous. Ovary 2-celled, 2-seeded. Fruit small, dry, enclosed in the calyx, stones 2, separable. *The Lemon verbena.*

Indigenous to Chile, Argentina and Uruguay. A common garden plant easily recognized by its very sweet scented leaves. Often grown as a pot-plant. Does well in Simla. Flowers: June—September.

PETREA VOLUBILIS, *Linn.*—A large climber. Leaves opposite, 2-4 inches long, elliptic, entire, scabrous on both sides. Flowers 6 inch across the violet corolla, in long terminal racemes. Calyx deeply 5-cleft, lobes linear-oblong, persistent, pale purplish-blue, strongly veined, 1 inch long in fruit. Corolla-tube short; limb obliquely 5-lobed. Stamens 4, didynamous, included. Ovary 2-celled, 2-seeded. Fruit enclosed in the calyx-tube, coriaceous, fleshy, indehiscent. *The Purple Wreath.*

Indigenous to the West Indies, Guiana and Brazil. Often grown in gardens in the plains. The brightly colored calyx is the most conspicuous portion of the flower and remains showy long after the fall of the corolla. Flowers: April.

CITHAREXYLUM SPINOSUM, *Linn.*—A tree 40 feet high, 3 feet in girth. Leaves opposite, 3-4 inches long, lanceolate or elliptic, acuminate, margin undulate, base cuneate, glabrous; petiole 3-5 inch long. Flowers 2 inch long, white, sweet-scented, in long drooping terminal racemes 6-12 inches long; pedicels very short. Calyx 1 inch long, tubular-campanulate, with 5 very short teeth. Corolla-tube cylindric; limb subequally 5-lobed. Stamens 4, didynamous, included. Ovary 4-celled, 4-ovuled. Fruit red, seated on the cup-shaped calyx, succulent, stones 2. *The Fiddle wood.*

Indigenous to tropical America. Commonly grown in gardens in the plains and usually called *C. subseriatum*, Sw. which is shrub from the West Indies. The wood is said to be specially suitable for making violins whence the generic and English names. Flowers: August—November.

DURANTA PLUMIERI, *Jacq.*—An evergreen shrub, more or less thorny. Leaves opposite, 1-2 by 6-12 inches, ovate, elliptic or obovate, usually acute, base cuneate or narrowed, margins entire or coarsely serrate, glabrous; petiole 1-2 inch long. Flowers 4 inch across, blue or white, in terminal and axillary racemes. Calyx 15 inch long, tubular, pubescent; teeth 5, very small. Corolla-tube 3 inch long, cylindric, limb subequally 5-lobed. Stamens 4, didynamous, included. Ovary 8-celled, 8-seeded. Fruit 3 inch long, orange, enclosed in the calyx which is narrowed at the apex into a beak, succulent, stones 4, 2-seeded.

Indigenous to tropical America from Mexico to Brazil. A very common hedge plant. Grows readily from cuttings. Flowers mostly March—April, but more or less all the year round.

TECTONA GRANDIS, *Linn. f.*—A large deciduous tree, branchlets quadrangular. Leaves opposite, 12-24 by 6-12 inches (often much larger in young plants), elliptic or obovate, scabrid above, stellately tomentose beneath, petiole 1-15 inches long. Flowers 25 inch across, white, in terminal erect panicles 1-3 feet long. Fruit 5 inch diameter, a bony 4-celled stone surrounded by a thick spongy covering, the whole enclosed in the inflated calyx. *The Teak.*

Indigenous to South India, Burma, etc. Occasionally grown in the plains as far west as Lahore. Easily recognized by its very large rough leaves and

huge panicles of flowers or fruits which can be seen most of the year. It is very sensitive to frost when young, but comparatively hardy when established. In the heavy frost of 1905 large planted trees did not suffer nearly as much as mango trees. Flowers : August—September.

LXIX. LABIATÆ.

Herbs, undershrubs or shrubs, rarely trees or climbers, stems almost always quadrangular, often aromatic and gland-dotted. Leaves opposite or whorled, stipules 0. Flowers bisexual, zygomorphic, rarely more or less actinomorphic, in cymes, the cymes of a pair of leaves often forming a whorl, the whorls often arranged in heads or spikes; bracts foliaceous or small; bracteoles usually minute. Calyx inferior, gamosepalous, persistent, 4-5-toothed, regular or 2-lipped. Corolla gamopetalous; tube usually cylindric, limb 5-lobed or by the fusion of the two upper lobes 4-lobed, 2-1-lipped or rarely subregular. Stamens 4, rarely 2, usually didynamous; anther-cells connate, separate or confluent, dehiscing longitudinally. Disk usually conspicuous as a swollen ring beneath the ovary, symmetrical or produced as a nectary which often exceeds the height of the ovary. Ovary 4-lobed or -partite; ovules 4, axile; style simple, filiform, arising from the centre of the ovary between the lobes; stigma usually 2-fid. Fruit of 4 dry (rarely succulent), 1-seeded nutlets at the base of the calyx, sometimes of 1-3 nutlets by suppression.

DISTRIB. A large family chiefly in warm dry temperate regions.

Unarmed shrubs or undershrubs.

Perfect stamens 4.

I. Flowers in whorls forming ovoid heads ... 1. *Thymus*.

II. Flowers in whorls forming dense cylindric spikes.

Woolly tomentose; stamens included in female flowers, equal ... 2. *Colebrookea*.

Hoary, pubescent or glabrous; stamens exserted.

Flowers pinkish, in dense villous bracteate whorls ... 3. *Pogostemon*.

Flowers yellowish, in long cylindric spikes; bracts minute ... 4. *Elsholtzia*.

III. Flowers axillary, not crowded into heads or spikes.

Leaves rugose above, tomentose beneath.

Tomentum white; flowers in lax cymes... 5. *Plectranthus*.

Tomentum buff-colored; flowers in dense axillary whorls ... 6. *Phlomis*.

Leaves thin, not rugose; flowers in loose whorls; calyx-lobes oblong ... 7. *Roylea*.

Perfect stamens 2.

Corolla 2-lipped; stamens exserted ... 8. *Perowskia*.

Corolla subequally 4-lobed; stamens included ... 9. *Meriandra*.

A spiny shrub ... 10. *Otostegia*.

1. **THYMUS**, Linn.

(The classical name of the common Thyme, *T. vulgaris*. **DISTRIB.** Species about 35; temperate parts of the Old World, mainly Mediterranean.)

THYMUS SERPYLLUM, *Linn. Sp. Pl.* (1753) p. 590.—An aromatic more or less procumbent shrub, twigs clothed with short white hairs. Leaves opposite, .2-.4 inch long, ovate-oblong, entire, gland-dotted on both sides, usually with a few long white cilia near the base; petiole very short. Flowers .15 inch across, pale-purple, dimorphous, in small whorls crowded into ovoid or nearly globose terminal spikes; bracts minute. Calyx .15 inch long, pubescent and gland-dotted, 2-lipped; upper lip shortly 3-toothed; lower lip with 2 linear strongly ciliate teeth as long as the tube, mouth hairy within. Corolla gland-dotted, the tube as long as the calyx, cylindric; limb obscurely 2-lipped, the upper lip erect, flat, notched, the lower spreading, 3-lobed. Stamen 4, exserted, didynamous; anther-cells separate. Disk symmetrical. Ovary 4-partite; style 2-fid. Nutlets smooth. *Wild Thyme*.

Himalaya 5-12,000 feet. Very common in grassy places, especially in the dry alpine pastures. Usually only a few inches high with tufted branches. The long procumbent shoots are about 12 inches long and frequently root. Flowers: May—October.

2. **COLEBROOKEA**, Smith.

(In honor of H. T. Colebrooke, a Judge of the Supreme Court in Calcutta and an accomplished botanist. **DISTRIB.** Species only the following in India and Burma.)

COLEBROOKEA OPPOSITIFOLIA, *Sm. Exot. Bot.* II (1805-07) p. 111, t. 115.—An erect shrub 4-10 feet high; twigs, petioles and inflorescence densely silky-tomentose. Leaves opposite, 4-10 by 1.5-3 inches, elliptic-oblong, acuminate, crenate, base acute, rugose and somewhat pubescent especially on the nerves above, softly tomentose beneath; lateral nerves 12-15 pairs, arcuate; petiole .4-1 inch long, stout. Flowers .1 inch long, white, functionally dioecious, in whorls forming panicle spikes 2-4 inches long by .2 inch diameter in flower, reaching .5 inch diameter in fruit; panicles terminal and in the axils of the upper leaves. Bracts solitary, .06 inch long, linear, pubescent; bracteoles several, .08 inch long, connate at the base into a whorl. Calyx .1 inch long in flower, 5-partite, teeth subulate, plumose with white hairs, elongating to .25 inch in fruit. Corolla a little shorter than the calyx; tube very short, lobes 4, subequal. Stamens 4, equal, included in female, exserted in male flowers, anther-cells confluent. Disk symmetrical. Ovary 4-partite; style

2-fid. Nutlets minute, usually solitary, obovoid-oblong, hairy at the tip.

Sub-Himalayan tract and outer Himalaya, ascending to 4,000 feet from the Indus eastwards. Common in weedy places, hedges and dry ravines. Flowers: January—April. The conspicuous catkin-like fruiting spikes are seen most of the year.

3. POGOSTEMON, Desf.

(From the Greek *pogon*, a beard, and *stemon*, thread; referring to the hairy filaments in some species. DISTRIB. Species 30; India and Malaya to Japan.)

POGOSTEMON PLECTRANTHOIDES, Desf. in *Mém. Mus. Par. II* (1815) p. 155, t. 6.—An aromatic gregarious undershrub about 4 feet high, stems usually purple, hoary-pubescent when young. Leaves opposite, 3-7 by 1·5-4 inches, ovate, acute, base rounded or cuneate, doubly serrate, pubescent or nearly glabrous; petiole ·5-2 inches long. Flowers ·3 inch long, white tinged with pink, in dense villous bracteate whorls, arranged in stout, cylindric, paniced spikes. Bracts up to ·3 inch long, foliaceous, broadly ovate, acute, softly hairy and glandular, enclosing a fascicle of sessile flowers mixed with bracteoles of various sizes mostly linear-lanceolate. Calyx ·2 inch long, tubular, pubescent, glandular; teeth 5, subequal, lanceolate, acute, one-third the length of the tube. Corolla-tube ·2 inch long, slender, curved; limb 2-lipped, upper lip 3-lobed, the middle lobe nearly ·2 inch long, longer and narrower than the obtuse lateral lobes; lower lip shorter than the upper, ovate-oblong, obtuse, entire. Stamens 4, exserted; filaments bearded; anther-cells confluent. Disk symmetrical. Ovary 4-partite; style shortly 2-fid. Nutlets minute, broadly ellipsoid, shining, dark-brown when ripe.

Sub-Himalayan tract from the Ravi eastwards, ascending to 5,000 feet. Usually met with quite locally in small patches. The leaves are aromatic with a smell resembling that of black currants. The plant is or used to be common in the compound of the Nurpur Forest Rest-house, Kangra. Flowers during the rainy season.

4. ELSHOLTZIA, Willd.

(In honor of J. S. Elsholtz, a German botanist of the 17th century. DISTRIB. Species 20; one each in Europe and Africa; the rest Asiatic.)

ELSHOLTZIA POLYSTACHYA, Benth. *Lab. Gen. & Sp.* (1832-36) p. 161.—A tall erect shrub 4-8 feet high; stem 3-4 inches diameter; branches subquadrangular, grooved, hoary when young. Leaves opposite, 3-6 by 1-2·5 inches, lanceolate or elliptic-lanceolate, acuminate, base narrowed, serrate, somewhat scabrid above when mature, hoary pubescent on the nerves and minutely gland-dotted beneath; lateral nerves 6 pairs, making a small angle with the mid-rib; petiole 0 or obscure,

Flowers $\cdot 1$ inch across, pale-yellowish, in long cylindric spikes 4-10 inches long by $\cdot 4$ inch across in flower, narrower in fruit, spikes solitary terminal or several in the axils of the upper leaves; bracts minute. Calyx $\cdot 05$ inch long, campanulate, pubescent, 5-toothed, in fruit $\cdot 1$ inch long, tubular, slightly ribbed. Corolla $\cdot 2$ inch long, pubescent, tube cylindric; limb small, spreading, 4-lobed, upper lobe erect, notched, the others entire, spreading. Stamens 4, didynamous, exserted; anthers broadly elliptic; the cells confluent. Disk produced behind the ovary into a large nectary. Ovary 4-partite; style shortly 2-fid. Nutlets oblong. Collett, Fl. Siml., fig. 123.

Himalaya 7-9,000 feet from Kashmir eastwards. Common east of the Sutlej. Usually in open shrubby places. Flowers: June—October.

5. PLECTRANTHUS, L'Hérit.

(From the Greek *plectron*, a spur, and *anthos*, a flower; referring to the gibbous base of the corolla-tube. DISTRIB. Species about 100; tropical and subtropical regions of the Old World.)

PLECTRANTHUS RUGOSUS, Wall. Pl. As. Rar. II (1831) p. 17.—A gregarious shrub, usually 2-3 feet high, aromatic. Leaves opposite, $\cdot 5\text{--}1\cdot 5$ by $\cdot 3\text{--}1$ inch, ovate or elliptic, obtuse, pubescent and rugose above, densely white-tomentose beneath; petiole $\cdot 15\text{--}\cdot 5$ inch long, slender. Flowers $\cdot 25$ inch long, white spotted with purple, in lax axillary cymes arranged in terminal leafy or leafless panicles; cymes shorter or longer than the leaves; peduncle and pedicels slender, woolly-pubescent. Calyx $\cdot 12$ inch long, tubular-campanulate, woolly-pubescent; teeth 5, small, triangular, equal. Corolla-tube straight, very short, gibbously swollen at the base; limb 2-lipped, upper lip shorter than the boat-shaped entire lower lip. Stamens 4, didynamous; anther-cells confluent. Disk produced in front into a nectary as long as the young fruit. Ovary 4-partite; style subequally 2-fid. Nutlets oblong, fruiting calyx scarcely enlarged. Vern. *Chhichhri* (Ku. Bash).

Himalaya 3-8,000 feet from the Indus eastwards. Salt Range. Also Trans-Indus. Abundant in dry places, usually gregarious. One of the commonest shrubs in the Himalaya, especially on exposed stony hillsides. It is said to keep off fleas. Flowers: March—October.

6. PHELOMIS, Linn.

(An old Greek name used by Dioscorides, from *phlox*, *phlogos*, a flame; the tomentum of some species was formerly used as tinder. DISTRIB. Species 65; Mediterranean region to China.)

PHELOMIS STEWARTII, Hook. f. in Fl. Brit. Ind. IV (1885) p. 692.—An erect shrub clothed with flocculent buff-colored woolly tomentum, branches terete. Leaves opposite, 2-3 by $\cdot 4\text{--}\cdot 8$ inch, oblong, obtuse or subacute, crenulate, stellately scabrous and rugose above, densely tomentose with prominent

veins beneath, very thick, base narrowed; petiole .2-5 inch long, stout and tomentose. Flowers nearly 1 inch long, in dense axillary rather distant whorls; bracts .5 inch long, subulate, rigid, acute, tomentose. Calyx .5 inch long, tubular, somewhat plicate upwards; teeth 5, short, spinescent. Corolla-tube short; limb 2-lipped, upper lip erect, helmet-shaped, laterally compressed, villous, lower lip spreading, 3-lobed, the middle lobe the broadest. Stamens 4; anther-cells divaricate, confluent. Disk symmetrical. Ovary 4-partite; style unequally 2-fid. Nutlets ovoid, glabrous.

Salt Range, 2,500-4,500 feet. Trans-Indus. About 1-2 feet high, branches rather stout. Flowers: April-May.

7. ROYLEA, Wall.

(In honor of Dr. J. F. Royle, Bengal Army, a distinguished botanist of the 19th century. **DISTRIB.** Species only the following.)

ROYLEA CALYCINA, Briquet, in *Engl. und Prantl, Pflanzenf.* IV, 3a (1895) p. 260.—A straggling shrub, 3-5 feet high, branches slender, terete, pale-brown, finely tomentose. Leaves opposite, 1-1.5 by .6-1 inch, ovate, acute, crenate or incisocrenate, base broadly cuneate, adpressed pubescent with fine hairs above, tomentose on the nerves and dotted with minute colorless glistening glands beneath; lateral nerves 2-3 pairs, the lowest pair sub-basal; petiole .1-1 inch long, slender, tomentose. Flowers .3 inch across, white tinged with pink, in axillary 6-10-flowered loose whorls; bracts .1 inch long, subulate, villous. Calyx pubescent and gland-dotted, 10-nerved; tube cylindric, .25 inch long; lobes 5, oblong-ob lanceolate, nearly as long as the tube, obtuse, reticulate, enlarged in fruit. Corolla .5 inch long, scarcely exceeding the calyx, tube cylindric with a ring of hairs within; limb 2-lipped, upper lip erect, entire, lower spreading, 3-fid, middle lobe broad, entire. Stamens 4; anther-cells diverging, ultimately confluent. Disk produced behind the ovary into a small nectary. Ovary 4-partite; style 2-fid, lobes subulate. Nutlets ovoid-oblong, obtuse, smooth. *Pholmis calycina*, Roxb. *R. elegans*, Wall. *Fl. Brit. Ind.*, IV, p. 679.

Outer Himalaya from Kashmir eastwards, ascending to 5,000 feet. Fairly common in hedges and shrubby places. Flowers: May-October.

8. PEROWSKIA, Karel.

(In honor of B. A. Perowskii, military governor of the province of Orenburg. **DISTRIB.** Species 4-5; Central Asia.)

PEROWSKIA ATRIPLICIFOLIA, Benth. in *DC. Prodr.* XII (1848) p. 261.—A strongly aromatic erect undershrub, 2-4 feet high; twigs terete, clothed with white stellate scurf. Leaves opposite, 1-2 by .3-.7 inch, oblong, narrowed at both ends,

crenate-serrate or subentire, more or less grey with stellate pubescence, dotted with yellow glistening glands beneath; petiole up to .3 inch long. Flowers .25 inch across, violet-blue, lavender or white, in distant few-flowered whorls, arranged in large terminal paniced interrupted spikes; whorls 2-6-flowered; bracts minute, woolly. Calyx .2 inch long, tubular-campanulate, very hairy, shortly 2-lipped, upper lip minutely 2-3-toothed, lower lip 2-toothed. Corolla slightly exceeding the calyx; tube slightly widened upwards and with a ring of hairs within, limb 2-lipped; the lower lip oblong, entire; the upper broad, erect, 3-lobed. Stamens, the 2 lower fertile, exserted, the 2 upper minute, imperfect; anther-cells linear, parallel. Disk swollen behind the ovary. Ovary 4-partite; style shortly 2-fid, the lobes membranous, wedge-shaped. Nutlets pyriform, smooth.

Kagan Valley, Hazara; Lahaul. 4,500-10,000 feet. Not common in the Punjab or Hazara, but abundant Trans-Indus. Forms rigid bushes. Flowers: September—October.

9. *MERIANDRA*, Benth.

(From the Greek *meros*, apart, and *aner*, *andros*, a man; referring to the separate anther-cells. **DISTRIB.** Species 2; one Abyssinian and the following.)

MERIANDRA STROBILIFERA, Benth. *Lab. Gen. & Sp.* (1832-36) p. 188.—An erect tomentose shrub, 2-5 feet high, smelling strongly of sage. Leaves opposite, 2-5 by .7-1.7 inches, usually oblong, acute or obtuse, base sagittate or cordate, margin more or less crenulate, upper surface harsh and very rugose, lower white with dense stellate woolly tomentum; petiole up to .4 inch long, very stout and woolly. Flowers .15 inch across, white, in dense-flowered whorls forming erect dense axillary and terminal spikes 1-2 inches long by .3 inch diameter; bracts .2 inch long, broadly ovate, acute, concave, thick, overlapping, densely woolly on the backs. Calyx .1 inch long, ovoid, woolly, upper lip concave, subentire, lower lip 2-fid, throat naked. Corolla .15 inch long, limb spreading, subequally 4-fid. Stamens included, the 2 lower fertile, one or both the upper imperfect; anther-cells separate, stipitate, pendulous. Disk symmetrical. Ovary 4-partite; style 2-fid. Nutlets obovoid, brown, smooth. Collett, Fl. Siml., fig. 125.

Himalaya 5-6,000 feet, from Kulu eastwards. Common on open dry hillsides and rocky places. More or less gregarious. Flowers: April—October.

MERIANDRA BENGALENSIS, Benth.—A shrub. Leaves 2-3 by 1-1.2 inches, obtuse, base rounded; petiole .3-5 inch long. Flowers in globose whorls .5-7 inch diameter, forming interrupted terminal spikes. Bracts caducous. Calyx .25 inch long, shortly pedicellate. Corolla white. *The Bengal Sage*.

Indigenous to Abyssinia. Cultivated by natives. The leaves have a strong camphoraceous smell and are used to keep insects from attacking

cloth. This plant is often mistaken for the *common sage*, *Salvia officinalis*, Linn., which has the flowers in few-flowered (not globose) whorls. Corolla violet. Anther-cells unequal, widely separated.

10. OTOSTEGIA, Benth.

(From the Greek *ous*, *otos*, an ear, and *stegein*, to cover : the reason for the name is not explained by Benth. **DISTRIB.** Species 8 ; North Africa to India.)

OTOSTEGIA LIMBATA, Benth. ex Hook. f. in *Fl. Brit. Ind.* IV (1885) p. 680.—A densely branched spiny shrub 2-3 feet high ; twigs subterete, finely grey-tomentose ; spines .3-.5 inch long, slender, straight. Leaves opposite, up to 1 by .3 inch, elliptic-oblongate, obtuse, entire, hoary-pubescent on both sides, thickish, minutely and obscurely gland-dotted, nerves obscure, base narrowed, petiole 0. Flowers .3 inch across, orange, in distant few-flowered axillary whorls ; bracts .3-.5 inch long, spinescent, some of them dilated with a spinescent mid-rib. Calyx-tube .3 inch long, villous, 10-nerved ; limb dilated, membranous, 2-lipped ; upper lip small 3-toothed ; lower lip .3 by .4 inch, subquadrate, shortly irregularly toothed, somewhat enlarged in fruit, whitish, membranous and reticulate. Corolla .5 inch long, tube short with a ring of hairs within ; upper lip very long, villous, erect, concave ; lower lip spreading, 3-fid, middle-lobe broad, emarginate. Stamens 4, exserted ; anther-cells ultimately divaricate. Disk symmetrical. Ovary 4-partite ; style 2-fid, lobes subulate. Nutlets oblong, obtuse.

Salt Range and outer Himalaya from the Jhelum westwards, ascending to 5,000 feet. In dry sunny places, very common and conspicuous owing to the fruiting calyx. It is in fruit most of the year. The spines are modified bracts, though they often appear to be of stipular origin. Flowers : May—June.

TINNEA ÆTHIOPICA, *Kotchy*.—A shrub 4-6 feet high: Flowers 1 inch long, deep maroon-purple, scented of violets. Calyx .5 inch long, with two broad entire lips. Indigenous to tropical Africa. Cultivated in Lahore. Flowers : February—March.

LXX. NYCTAGINACEÆ.

Herbs, shrubs or trees. Leaves usually opposite, entire ; stipules 0. Flowers usually bisexual and regular ; bracts often involucrate. Perianth monophyllous, usually petaloid ; tube persistent, enclosing the fruit ; limb 3-5-lobed, plicate in bud, persistent or deciduous. Stamens 1-30, hypogynous. Ovary 1-celled, free ; ovule solitary, basal, erect. Fruit membranous, indehiscent, enclosed in the coriaceous perianth-tube.

The family contains no indigenous woody plants, but the following are common and conspicuous in cultivation :—

BOUGAINVILLEA, *Commerson*.—Thorny shrubs or trees often scrambling. Leaves alternate. Flowers small, yellow, supported by large colored bracts, either 1 or 3 flowers surrounded by 3 bracts, stamens 7-8 included, filaments connate below.

BOUGAINVILLEA GLABRA, *Choisy*.—A large shrub, suberect with scrambling branches or scrambling over tall trees; branches glabrous, armed with recurved thorns. Leaves 1-2 inches long, lanceolate, acuminate, glabrous; petiole .2-.3 inch long. Flowers 1 inch long, .25 inch across, in threes, each flower adnate to a large magenta colored reticulate ovate cordate bract about 2 inches by 1.5 inches. Perianth tubular, limb small.

Indigenous to Brazil. Very commonly grown in gardens in the plains. Hardy and flowers freely. Easily grown from cuttings. Flowers mainly in February—March.

BOUGAINVILLEA SPECTABILIS, *Willd.*—Similar to the above but with pale corky bark the cracks forming rectangular plates, shoots petioles and leaves softly pubescent. Leaves 1-2 inches long, broadly ovate or elliptic, acute or acuminate; petiole .3-.5 inch long. Bracts 1.5 by 1.2 inches, purple, magenta or brick red.

Indigenous to Brazil. Cultivated in gardens in the plains but not hardy in Lahore requiring protection in winter. Propagated by layering. The brick-red variety is known as *B. lateritia* in gardens.

LXXI. AMARANTACEÆ.

Herbs or undershrubs, rarely trees. Leaves opposite or alternate; stipules 0. Flowers usually bisexual, small, usually in simple or paniculate spikes; bracts hyaline or scarious; bract-eoles 2, scarious. Perianth usually of 5 free or connate, hyaline or scarious segments, persistent, imbricate in bud. Stamens usually 1-5, opposite the perianth-segments; filaments usually connate at the base with interposed staminodes forming a hypogynous cup; anthers 1-2-celled. Ovary 1-celled, ovoid, or globose; ovules 1 or more; style 0 or more or less produced, simple or 2-4-branched; stigma capitate or small. Fruit a membranous utricle, capsule or berry, enclosed in or supported by the persistent perianth. **DISTRIB.** A weedy family of Tropical and Sub-tropical regions.

Glabrous or nearly so; spikes or racemes not dense.

Flowers pedicellate; racemes 2-12 inches long;
fruit more than 1-seeded ... 1. *Deeringia*.

Flowers subsessile; spikes .5-2 inches long;
fruit 1-seeded ... 2. *Bosea*.

More or less tomentose; spikes dense, silky or
woolly ... 3. *Ærud*.

1. DEERINGIA, R. Br.

(In honor of G. C. Deering, a botanist of the 18th century. **DISTRIB.** Species 5-6; Asiatic, Australian and Polynesian.)

DEERINGIA CELOSIODES, *R. Br. Prodr.* (1810) p. 413.—A tall scrambling undershrub 6-12 feet high. Leaves alternate, 2-5 by 1-2 inches, ovate or ovate-lanceolate, long-pointed, entire, glabrescent; petiole .2-1 inch long, slender. Flowers .2 inch diameter, greenish-white, in axillary and terminal simple or panicled spike-like racemes 2-12 inches long; pedicels .05

inch long ; bracts minute. Perianth-segments 5, oblong, herbaceous, spreading or reflexed. Stamens 5, united at the base ; anthers 2-celled ; staminodes 0. Ovary ovoid ; style short ; stigmas 2-4, subulate. Berry .2 inch diameter, scarlet, seated on the spreading perianth. Seeds usually 3.

Sub-Himalayan tract and outer Himalaya ascending to 5,000 feet, from the Ravi eastwards. Common in hedges and scrub forests. Flowers July—October.

2. BOSEA, Linn.

(In honor of E. G. Bose, a German botanist of the 18th century. **DISTRIB.** Species 3 ; Canaries, Mediterranean and Himalayan.)

BOSEA AMHERSTIANA, Hook. f. in *Fl. Brit. Ind.* IV (1885) p. 716.—A glabrous straggling shrub. Leaves alternate, 2-6 by 1-3 inches, ovate, acute, entire, base usually broadly cuneate, glabrous ; petiole .2-.7 inch long. Flowers .2 inch diameter, green, bracteate and 2-4-bracteolate, subsessile, in axillary and terminal, simple or paniced spikes .5-2 inches long ; bracts and bracteoles rounded, closely imbricate, green with white margins. Perianth-segments 5, erect, ovate, concave, herbaceous with membranous margins. Stamens 5, united at the base, inserted outside a 10-lobed hypogynous disk ; anthers 2-celled. Ovary oblong ; style very short ; stigmas 2-3, recurved. Berry .15 inch diameter, crimson, seated on the adpressed perianth-segments. Seed 1, black, polished, testa crustaceous.

Himalaya ascending to 6,500 feet from Kashmir eastwards. Fairly common. Apt to be mistaken for *Deeringia celosioides*, but with much shorter spikes in smaller denser panicles. Flowers : May—October.

3. ÆRUA, Forsk.

(The Arabic name of one of the species.)

Herbs or undershrubs. Leaves alternate or opposite, more or less hairy. Flowers bisexual or polygamous, in simple or paniced spikes ; bracteate and 2-bracteolate. Perianth-segments 5, rarely 4, short, membranous, all or the 3 inner woolly. Stamens 5, rarely 4 ; filaments connate below with interposed linear staminodes in a cup ; anthers 2-celled. Ovary ovoid or subglobose, 1-celled ; ovule 1, pendulous from a long basal funicle ; style simple ; stigma capitate or 2-branched. Fruit a membranous utricle or coriaceous capsule. **DISTRIB.** Species 15 ; Tropical Asia and Africa.

An erect shrubby plant, hoary-tomentose ;
flowers unisexual, dioecious 1. *A. javanica*.

A straggling weak undershrub ; hoary-pubescent ; flower bisexual 2. *A. scandens*.

1. **ÆRUA JAVANICA**, Juss. in *Ann. Mus. Par.* II (1803) p. 131.—Shrubby, erect, stiff, hoary-tomentose, 2-3 feet high ;

branches covered with thick easily detachable stellate tomentum. Leaves alternate, 1·2·5 by ·1·6 inch, variable, linear-oblong or oblong-oblongeolate, subacute or obtuse, thick, more or less densely stellate-tomentose on both sides, entire, sessile, or narrowed into a short petiole. Flowers small, dull-white, unisexual, usually diœcious, in cylindric spikes 1·6 inches long, arranged in leafless terminal panicles; bracteoles ·1 inch long, broadly ovate, white, hyaline. Male flowers; perianth ·07 inch long, segments 5, elliptic-oblong, woolly on the backs. Stamens 5. Ovary very small. Female flowers; perianth ·1 inch long; segments oblong, apiculate. Style ·02 inch long; stigmas 2, as long as the style. Utricle orbicular-ovoid.

Plains and Sub-Himalayan tract in dry places ascending to 4,000 feet. Common on railway embankments and waste places. Abundant on the hills near the Jhelum in Rawalpindi District. In flower or fruit most of the year.

2. *ÆRUA SCANDENS*, Wall. Cat. (1828) No. 6911.—A weak straggling undershrub 3·4 feet high; branches grey-pubescent or tomentose. Leaves usually alternate, 1·4 by ·4·2 inches, elliptic or elliptic-lanceolate, acute at both ends, clothed on both sides with adpressed grey pubescence, entire, finely mucronate; petiole ·2·5 inch long. Flowers small, whitish, bisexual, in ovoid or shortly cylindric axillary and terminal spikes ·2·1 inch long, usually forming a very lax terminal panicle; bracteoles less than ·1 inch long, ovate, acuminate, white, hyaline. Perianth ·1 inch long; segments 5, lanceolate, acuminate, with long silky hairs on the backs. Stamens 5. Style ·02 inch long; stigma capitate. Utricle broadly ovate.

Sub-Himalayan tract from the Indus eastwards ascending to 6,000 feet in the Himalaya. In hedges and waste places growing amongst bushes. Not a climber but the branches support themselves by leaning against other plants. This species is not found in the very dry places where *A. javanica* grows. In flower or fruit most of the year.

LXXII. CHENOPODIACEÆ.

Herbs, shrubs or rarely small trees. Leaves usually alternate, sometimes wanting or much reduced; stipules 0. Flowers small, usually greenish, 2·1-sexual; bracts 1 or 0; bracteoles 2 or 0. Perianth simple, sepaloid; segments 3·5, more or less connate, imbricate in bud; sometimes wanting in female flowers. Stamens as many as or fewer than the perianth-segments, opposite to them, filaments usually free, sometimes with interposed staminodes. Disk occasionally present within and uniting the bases of the stamens. Ovary 1-celled; ovule 1, basal or lateral; style long or short; stigmas 2, rarely 3·5. Fruit usually an utricle, enclosed in the persistent perianth which is variously enlarged. Seed horizontal or vertical; embryo curved, horse-

shoe-shaped or spiral. **DISTRIB.** A family conspicuous in dry or saline habitats.

Leaves and branches alternate.

Leaves glabrous or hoary.

- | | | | |
|--|-----|-----|---------------------|
| Leaves linear-oblong, terete; fruiting perianth not winged | ... | ... | 1. <i>Suaeda</i> . |
| Leaves minute, subglobose; fruiting perianth transversely winged | ... | ... | 2. <i>Salsola</i> . |
| Leaves densely stellate-tomentose at least when young | ... | ... | 3. <i>Eurotia</i> . |

Leaves and branches opposite.

Embryo spiral; perianth 5-partite.

- | | | | |
|--|-----|-----|-------------------------|
| Seed horizontal; wings of the fruiting perianth 5, equal | ... | ... | 4. <i>Haloxylon</i> . |
| Seed vertical; wings of the fruiting perianth 5, unequal, or fewer | ... | ... | 5. <i>Anabasis</i> . |
| Embryo curved; perianth obpyramidal, 3-lobed | ... | ... | 6. <i>Halostachys</i> . |

1. *SUÆDA*, Forsk.

(From *suaed*, the Arabic name for one of the species. **DISTRIB.** Species 40; seacoasts and salt steppes of the world.)

SUÆDA FRUTICOSA, Forsk. *Fl. Egypt.-Arab.* (1775) p. 70.—A much-branched succulent shrub 2-4 feet high; stem pale, glabrous, leaf-scars prominent, raised. Leaves alternate, .2-.6 by .05-.15 inch, linear-oblong or ellipsoid, obtuse, fleshy, half-terete, floral-leaves small, sessile. Flowers minute, bisexual, 1-3 in the leaf axils, forming terminal interrupted spikes, bracteate and 2-bracteolate; bracts and bracteoles .05 inch long, membranous. Perianth less than .1 inch long, 5-lobed, subglobose; segments equal, obtuse, incurved, concave. Stamens 5; filaments short; anthers large. Ovary ovoid; style 0; stigmas 2-5, usually 3. Utricle small, membranous, included in the perianth. Vern. *Láni*, *Lána*.

Plains of the Punjab. Common in saline soils, often gregarious. *Sajji*, an impure form of carbonate of soda, is sometimes made from this plant being extracted from the ashes. The plant is used as fodder for camels. Flowers September—October. The flowers have a fœtid smell.

2. *SALSOLA*, Linn.

(A diminutive of *salsus*, salted; alluding to the saline habitat.)

Herbs or shrubs. Leaves usually alternate, sessile or amplexicaul, often short and pungent. Flowers small, solitary or fascicled, axillary, 2-sexual, 2-bracteolate. Perianth 5- (rarely 4-) partite; segments concave, accrescent in fruit, completely embracing the utricle, usually with a broad horizontal

scarious wing attached to the back above the middle. Stamens 5 or fewer, usually hypogynous. Stigmas 2, rarely 3. Utricle ovoid or subglobose, fleshy or membranous. **DISTRIB.** Species 40; Europe, Africa, temperate Asia, Australia and North America.

Leaves minute, subglobose, densely crowded ... 1. *S. fetida*.

Leaves terete, cylindric or obovoid .15-.3 inch long ... 2. *S. vermiculata*.

1. *SALSOLA FETIDA*, Del. *Fl. Ægypt. Illustr.* (1812) n. 310.—A hoary much-branched shrub 3-4 feet high; stem stout, branchlets slender, hairy when young. Leaves alternate, minute, subglobose, fleshy, densely crowded, the floral leaves rather longer, imbricate, forming short spikes. Bracteoles .05 inch long, suborbicular, fleshy. Perianth minute, in fruit with silvery-white, membranous, obovate, overlapping wings .05 inch long. Vern. *Lána*; *Gora lána*; *Láni*.

Throughout the plains of the Punjab. Common on saline soils. Used for making *saffi*, an impure form of carbonate of soda. Flowers November—December. [According to the Fl. Brit. Ind. *S. verrucosa*, M. Bieb. is similar but has flowers in dense clusters and spikes and fruiting perianth $\frac{1}{4}$ inch diameter, dark-brown. I cannot distinguish this from *S. fetida*. The color of the fruiting perianth is a character of doubtful value and there are plants in Lahore with fruiting perianths fully as large but silvery-white on the living plant. Boissier, *Flora Orientalis*, Vol. IV, p. 961, notes under *S. verrucosa*, M. Bieb. "Affinis *S. fetida* a qua foliis inferioribus breviter filiformibus $1\frac{1}{2}$ -2 lineas longis nec ovato-orbiculatis differt". I have seen no Punjab specimens with such leaves.]

2. *SALSOLA VERMICULATA*, Linn. *Sp. Pl.* (1753) p. 323.—A small glabrous shrub, branchlets pale, often whitish. Leaves alternate, .15-.3 inch long, terete, cylindric or obovoid, not crowded, bases dilated, semiamplexicaul, the floral leaves shorter, ovate, concave, not imbricate. Bracteoles .07 inch long, ovate, fleshy with membranous margins. Perianth minute, in fruit with silvery-white, membranous, cuneate-obovate wings .15 inch long.

Apparently not widely distributed but has been collected near Mari by J. R. Drummond who notes that it is common on either bank of the Indus.

3. *EUROTIA*, Adans.

(From the Greek *eurus*, large and *ous, otos*, an ear; referring the bracts. **DISTRIB.** Species 2; dry temperate regions in the Northern Hemisphere.)

EUROTIA CERATOIDES, C. A. Mey. in Ledbr. *Fl. Alt.* IV (1853) p. 239.—A dense shrub 1-3 feet high, hoary with stellate tomentum. Leaves alternate, .5-1.5 by .2-.5 inch, oblong, elliptic or ovate-lanceolate, obtuse, entire, stellate-tomentose when young; petiole minute to .1 inch long. Flowers minute, 1-sexual, in axillary clusters forming spikes towards the ends

of the branches. Male flowers ; perianth 4-partite, membranous hairy. Stamens 4. Female flowers ; 2-bracteate ; bracts conduplicate, united to above the middle, tips free spreading ; perianth 0. Ovary ellipsoid, compressed, silky ; stigmas 2, filiform. Utricle $\cdot 1$ inch long, enclosed in a hard capsule which is hidden by silky grey hairs and is composed of the bracts ; the capsule 4-angled, 2-horned at the apex, ultimately 4-valved.

Dry inner Himalaya 8-14,000 feet. Kunawar. Common in Tibet and Trans-Indus. Flowers : July—September.

4. HALOXYLON, Bunge.

(From the Greek *hals*, the sea, and *aulon*, wood ; referring to the saline habitats.)

Shrubs or small trees, branches opposite, jointed. Leaves opposite, triangular and scale-like or longer and terete. Flowers small, solitary or spicate, bisexual, axillary ; bracteoles 2, broad, ovate. Perianth 5-partite ; segments concave, accrescent, horizontally winged. Stamens 5 or fewer, on the margin or base of a cupular disk with interposed rounded or square staminodes. Stigmas 2-5, short, subulate. Utricle globose or depressed, enclosed in the perianth. Seed horizontal. DISTRIB. Species 8-10 ; Mediterranean, West and Central Asia, India.

Leaves distinct 1. *H. recurvum*.

Leaves reduced to the dilated tips of the joints.

1-2 feet high ; spikes 2-3 inches long ; leaves woolly within 2. *H. salicornicum*.

4-6 inches high ; spikes 1 inch long ; leaves not woolly 3. *H. multiflorum*.

1. HALOXYLON RECURVUM, Bunge, ex Boiss. *Fl. Orient.* IV (1879) p. 949.—A straggling gregarious shrub ; branches glabrous, pruinose ; joints $\cdot 3\text{--}8$ inch long. Leaves $\cdot 1\text{--}3$ inch long, triangular or half-terete, ovate-subulate or ellipsoid, obtuse or acute, sessile. Flowers axillary forming interrupted spikes 2-6 inches long ; floral leaves $\cdot 1$ inch long, ovate, slightly exceeding the bracteoles ; bracteoles ovate, acute, thick, fleshy. Perianth-segments $\cdot 2$ inch long, somewhat fleshy, ovate, sub-obtuse, closing over the fruit ; wings $\cdot 1$ inch long, spreading, orbicular, closely veined, membranous, attached to the middle of the back of the perianth-segment. Vern. *Khâr*.

Punjab Plains ; Salt Range ascending to 2,500 feet. Multan, Sirsa. Flowers : November—December. Apt to be mistaken for *Anabasis setifera* (q. v.)

Of all the indigenous members of the Chenopodiaceæ the *khâr* is the most important for the manufacture of barilla (*sajji*). The plant is cut at the time of flowering in October—November, when it is about $2\frac{1}{2}$ feet high. It is then left to dry for 15 days. A hole 1 foot deep and 3 feet broad is dug in the ground, and round this the plant is piled to a considerable height. The pile is then set

on fire and the juice of the plant runs into the hole. When the hole is full the juice is stirred for a couple of hours with a stick after which a little earth is sprinkled on the top and it is allowed to cool when it solidifies into a hard mass. (*Vide* Multan Gazetteer 1901-02, page 229). *Haloxylon recurvum* is also appreciated as a fodder for camels, and it is often cut and sold for this purpose.

2. *HALOXYLON SALICORNICUM*, Bunge, ex Boiss. *Fl. Orient.* IV (1879) p. 949.—An erect twiggy leafless shrub 1-2 feet high; branches pale, grey or yellowish; joints .25-.5 inch long, produced into 2 short triangular points woolly within. Flowers in erect spikes 2-3 inches long; bracteoles .07 inch long, elliptic or obovate, thick, axils woolly. Perianth-segements .1 inch long, tips short, obtuse; wings .1 inch long, orbicular-obovate, closely veined, membranous, attached to the back of the perianth-segment above the middle.

Punjab Plains. Kalabagh; Multan; Montgomery; Ferozepore. Used as fodder for camels. Flowers: October.

3. *HALOXYLON MULTIFLORUM*, Bunge, ex Boiss. *Fl. Orient.* IV (1879) p. 949.—A dwarf shrub 4-6 inches high; stem very short, branches almost fascicled. Tips of the joints and bracteoles not woolly within. Spikes 1 inch long. Otherwise as for *H. salicornicum*.

North-Western Punjab Plains and the Salt Range ascending to 2,000 feet. I have seen no specimens.

5. *ANABASIS*, Linn.

(From the Greek *anabasis* an ascent; referring to the wings of the perianth-segments.)

Shrubs or undershrubs, branches opposite, jointed. Leaves opposite, triangular and scale-like or fleshy. Flowers small, solitary or clustered, axillary, bisexual; bracteoles 2, minute. Perianth 5-partite almost to the base; segments all or three only (or rarely none) winged in fruit. Stamens 5, on a short disk, alternating with 5 staminodes. Stigmas 2. Utricle subglobose, dorsally compressed, included in or exerted from the perianth. Seed vertical. **DISTRIB.** Species 17; Mediterranean, West and Central Asia, India.

Leaves distinct, cylindric, thick, fleshy; flowers
in clusters of 3-7 1. *A. setifera*.

Leaves reduced to two triangular teeth;
flowers solitary 2. *A. phyllophora*.

1. *ANABASIS SETIFERA*, Moq. in *Chenop. Enum.* (1840) p. 164.—A dwarf pale glaucous shrub 1-2 feet high, joints variable in length, fully 1 inch long on vigorous shoots. Leaves .15-.3 inch long, oblong, cylindric or subclavate, obtuse, tipped with a caducous bristle, sessile, axils woolly. Flowers in clusters of 3-7 forming interrupted spikes; floral leaves oblong

of the branches. Male flowers ; perianth 4-partite, membranous hairy. Stamens 4. Female flowers ; 2-bracteate ; bracts conduplicate, united to above the middle, tips free spreading ; perianth 0. Ovary ellipsoid, compressed, silky ; stigmas 2, filiform. Utricle 1 inch long, enclosed in a hard capsule which is hidden by silky grey hairs and is composed of the bracts ; the capsule 4-angled, 2-horned at the apex, ultimately 4-valved.

Dry inner Himalaya 8-14,000 feet. Kunawar. Common in Tibet and Trans-Indus. Flowers : July—September.

4. HALOXYLON, Bunge.

(From the Greek *hals*, the sea, and *xulon*, wood ; referring to the saline habitats.)

Shrubs or small trees, branches opposite, jointed. Leaves opposite, triangular and scale-like or longer and terete. Flowers small, solitary or spicate, bisexual, axillary ; bracteoles 2, broad, ovate. Perianth 5-partite ; segments concave, accrescent, horizontally winged. Stamens 5 or fewer, on the margin or base of a cupular disk with interposed rounded or square staminodes. Stigmas 2-5, short, subulate. Utricle globose or depressed, enclosed in the perianth. Seed horizontal. **DISTRIB.** Species 8-10 ; Mediterranean, West and Central Asia, India.

Leaves distinct 1. *H. recurvum*.

Leaves reduced to the dilated tips of the joints.

1-2 feet high ; spikes 2-3 inches long ; leaves woolly within 2. *H. salicornicum*.

4-6 inches high ; spikes 1 inch long ; leaves not woolly 3. *H. multiflorum*.

1. HALOXYLON RECURVUM, Bunge, ex Boiss. *Fl. Orient.* IV (1879) p. 949.—A straggling gregarious shrub ; branches glabrous, pruinose ; joints 3-8 inch long. Leaves 1-3 inch long, triangular or half-terete, ovate-subulate or ellipsoid, obtuse or acute, sessile. Flowers axillary forming interrupted spikes 2-6 inches long ; floral leaves 1 inch long, ovate, slightly exceeding the bracteoles ; bracteoles ovate, acute, thick, fleshy. Perianth-segments 2 inch long, somewhat fleshy, ovate, sub-obtuse, closing over the fruit ; wings 1 inch long, spreading, orbicular, closely veined, membranous, attached to the middle of the back of the perianth-segment. Vern. *Khár*.

Punjab Plains ; Salt Range ascending to 2,500 feet. Multan, Sirsa. Flowers : November—December. Apt to be mistaken for *Anabasis setifera* (q. v.)

Of all the indigenous members of the Chenopodiaceæ the *khár* is the most important for the manufacture of barilla (*sajji*). The plant is cut at the time of flowering in October—November, when it is about 2½ feet high. It is then left to dry for 15 days. A hole 1 foot deep and 3 feet broad is dug in the ground, and round this the plant is piled to a considerable height. The pile is then set

on fire and the juice of the plant runs into the hole. When the hole is full the juice is stirred for a couple of hours with a stick after which a little earth is sprinkled on the top and it is allowed to cool when it solidifies into a hard mass. (*Vide* Multan Gazetteer 1901-02, page 229). *Haloxylon recurvum* is also appreciated as a fodder for camels, and it is often cut and sold for this purpose.

2. *HALOXYLON SALICORNICUM*, Bunge, ex Boiss. *Fl. Orient.*

IV (1879) p. 949.—An erect twiggy leafless shrub 1-2 feet high; branches pale, grey or yellowish; joints .25-.5 inch long, produced into 2 short triangular points woolly within. Flowers in erect spikes 2-3 inches long; bracteoles .07 inch long, elliptic or obovate, thick, axils woolly. Perianth-segments .1 inch long, tips short, obtuse; wings .1 inch long, orbicular-obovate, closely veined, membranous, attached to the back of the perianth-segment above the middle.

Punjab Plains. Kalabagh; Multan; Montgomery; Ferozepore. Used as fodder for camels. Flowers: October.

3. *HALOXYLON MULTIFLORUM*, Bunge, ex Boiss. *Fl. Orient.*

IV (1879) p. 949.—A dwarf shrub 4-6 inches high; stem very short, branches almost fascicled. Tips of the joints and bracteoles not woolly within. Spikes 1 inch long. Otherwise as for *H. salicornicum*.

North-Western Punjab Plains and the Salt Range ascending to 2,000 feet. I have seen no specimens.

5. *ANABASIS*, Linn.

(From the Greek *anabasis* an ascent; referring to the wings of the perianth-segments.)

Shrubs or undershrubs, branches opposite, jointed. Leaves opposite, triangular and scale-like or fleshy. Flowers small, solitary or clustered, axillary, bisexual; bracteoles 2, minute. Perianth 5-partite almost to the base; segments all or three only (or rarely none) winged in fruit. Stamens 5, on a short disk, alternating with 5 staminodes. Stigmas 2. Utricle subglobose, dorsally compressed, included in or exerted from the perianth. Seed vertical. **DISTRIB.** Species 17; Mediterranean, West and Central Asia, India.

Leaves distinct, cylindric, thick, fleshy; flowers
in clusters of 3-7 1. *A. setifera*.

Leaves reduced to two triangular teeth;
flowers solitary 2. *A. phyllophora*.

1. *ANABASIS SETIFERA*, Moq. in *Chenop. Enum.* (1840) p. 164.—A dwarf pale glaucous shrub 1-2 feet high, joints variable in length, fully 1 inch long on vigorous shoots. Leaves .15-.3 inch long, oblong, cylindric or subclavate, obtuse, tipped with a caducous bristle, sessile, axils woolly. Flowers in clusters of 3-7 forming interrupted spikes; floral leaves oblong

or rounded; bracteoles minute, linear, membranous ciliate. Perianth-segments .1 inch long, oblong, obtuse, scarious; wings 3-5, somewhat unequal, erecto-patent, rounded, the largest .2 inch long, rather broader than long, closely veined, membranous, attached near the top of the segment.

Salt Range, Hills near Kalabagh. Resembles *Haloxylon recurvum* rather closely but easily recognized in the herbarium by its pale color whereas *H. recurvum* dries a dark-grey. In *Anabasis setifera* the perianth-segments in fruit have unequal wings less spreading than in *H. recurvum*, and the utricle is a different shape. Flowers about October.

2. ANABASIS PHYLLOPHORA, Kar. & Kir. in Bull. Soc. Nat. Mosc. (1840) p. 731.—A dwarf glabrous shrub, stems many, erect from a woody stock; joints long, terminating in two triangular acute teeth. Flowers solitary, in opposite axils, spicate, staminodes ciliate; fruiting perianth with 3 conniving wings, the posterior the largest.

Salt Range near the Jhelum River. This description is from Hooker who has taken it from Boissier. The plant has not been collected in flower or fruit in the Punjab as yet and should be looked for. Aitchison's specimen in Herb. Dehra might be a scrap of *Haloxylon salicornicum*.

6. HALOSTACHYS, C. A. Mey.

(From the Greek *hals*, the sea, and *stachys*, a spike. DISTRIB. Species only the following; S. E. Russia to the Punjab.)

HALOSTACHYS CASPICA, C. A. Mey. in Bull. Soc. Nat. Mosc. (1838) p. 361.—An erect pseudo-leafless shrub, much-branched, the young branches herbaceous, jointed, the older woody, swollen slightly at the nodes, branches opposite. Flowers minute, in threes in the axils of peltate fleshy scales forming dense cylindrical spikes which mostly terminate very short lateral shoots; spikes in flower .5-1 inch long, .1 inch across the bracts, in fruit 1-2 inches long. Perianth obpyramidal, 3-lobed at the top; lobes subequal, rounded on the backs, incurved. Stamen 1, protandrous. Ovary globose or ovoid; stigmas 2, broad, wavy on the edges. Spikes in fruit breaking up leaving a very slender woody axis, the bracts falling and liberating the spongy angular fruiting perianths which are .05 inch long. Seed curved.

Punjab Plains. Has only been collected once by A. V. Monro near Multan. Reaches 4 feet in height. Grows on moist saline soil. Flowers in July, fruits in the cold season.

LXXIII. PHYTOLACCACEÆ.

A family differing from the Chenopodiaceæ in habit and in the (usually) polycarpous ovary. There are no woody indigenous representatives.

RIVINA HUMILIS, Linn.—A plant resembling *Deeringia celosioides*, B. Br. but with 4-merous flowers and a single capitate stigma. Ovary 1-celled. Seed solitary. Indigenous to Tropical America. Occasionally grown in

gardens in the plains and found as an escape in many parts of India but not as yet in the Punjab. Flowers more or less all the year round.

LXXIV. POLYGONACEÆ.

Herbs, sometimes shrubs, rarely trees. Leaves alternate, simple, rarely opposite, usually entire, stipules scarious or membranous, usually sheathing the stem. Flowers mostly small, usually bisexual, solitary or in small clusters variously arranged; pedicels usually jointed. Perianth simple; lobes or segments 3-6, persistent, imbricate in bud. Stamens 6-9, rarely more or fewer, opposite to the perianth-segments; filaments free or connate. Disk annular, glandular or 0. Ovary 1-celled, superior, free, 2-4-angled; ovule solitary, basal; styles 1-3; stigmas various. Fruit a nut, usually enclosed in the perianth. **DISTRIB.** A family mainly of the Northern temperate region.

A nearly leafless shrub of the desert region;
styles 4; nut setose 1. *Calligonum*.

A leafy shrub of the Sub-Himalayan and Himalayan region; styles 3; nut enclosed in the perianth 2. *Rumex*.

1. **CALLIGONUM**, Linn.

(From the Greek *kalos*, beautiful, and *gonu*, an angle; referring to the quadrangular ovary. **DISTRIB.** Species 20; N. Africa, W. and Central Asia.)

CALLIGONUM POLYGONOIDES, Linn. *Sp. Pl.* (1753) p. 530.— A nearly leafless shrub or at times a dwarf tree; branches somewhat zigzag, bark smooth whitish; twigs slender, green, mostly fascicled. Leaves very scanty, minute, thin, linear-subulate; stipules very short, membranous, obliquely amplexicaul. Flowers pink, in fascicles of 2-5, in the axils of the stipules; pedicels about .1 inch long. Perianth .1 inch long, cleft about two-thirds the way down; segments 5, obovate, thin, membranous, red with broad white margins. Stamens 12, filaments swollen, hairy and connate at the base. Ovary 4-angled, angles tuberculate; styles 4, slightly connate at the base; stigmas capitate. Fruit densely clothed with branched bristles with dilated often confluent bases, nucleus .3 inch long, oblong, much longer than the persistent perianth. Brandis, Ind. Trees, fig. 176. Vern. *Phóg*.

A plant of dry sandy soils common in the Rajputana Desert extending to the Punjab some 60 miles north of Multan, from here southwards it is abundant in the Bari Doab. Forms a great part of the vegetation west of Muzaffargarh and to the west of Shahpur. Also Trans-Indus. Usually seen as a small shrub 3-4 feet high, growing on sand-dunes. Occasionally a small tree 12-15 feet high with a trunk 2-3 feet in girth. The internodes are 1-1.5 inches long and the nodes somewhat swollen. With its pale white shining bark on the leafless branches it has the appearance of being dead. The green slender shoots with inconspicuous leaves appear in February and March and

it is soon afterwards covered with its strongly scented pink flowers, filling the air with the odor of over-ripe fruit. The flowers are collected and eaten. The heartwood is reddish-brown, very hard and fibrous. It is used only for fuel. According to Brandis For. Fl., p. 372, and Ind. Trees, p. 520-1 the plant is found as far north as Lahore. I have never seen it anywhere near Lahore nor at Changa Manga or Montgomery. It does not appear to occur near Delhi or Hissar but is found in the extreme south of Patiala State.

2. RUMEX, Linn.

(The old Latin name used by Pliny for the Sorrel, *Rumex Acetosella*.
DISTRIB. Species 100; mainly in north temperate regions.)

RUMEX HASTATUS, *D. Don, Prodr. Fl. Nep.* (1825) p. 74.—A small erect shrub 1-3 feet high; twigs herbaceous, striate. Leaves .5-2 inches long, very variable, hastate with the central lobe linear-oblong or sometimes deltoid, thickish, glaucous, nerveless; petiole up to 2 inches long, flattened; stipules .1 inch long, membranous, disappearing with age. Flowers small, pinkish, polygamous, in small clusters on the racemose branches of a large terminal panicle; pedicels .1-1.5 inch long (in fruit), very slender, jointed near the base. Perianth-segments 6, the three outer .05 inch long, oblong, the three inner rounded, much enlarged in fruit. Stamens 6. Ovary 3-angled; styles 3; stigmas fimbriate. Fruit a small 3-angled nut .07 inch long, enclosed by the much enlarged inner perianth-segments which are .2 inch long and rather more broad, reticulate, membranous, apex retuse, base deeply cordate with a tubercle in the sinus, often delicately tinged with pink. Collett, Fl. Siml., fig. 136.

Sub-Himalayan tract and Himalaya ascending to 8,000 feet. At low elevations it is often found growing on shingle in dry stream beds. In the Himalaya it is abundant on fresh mineral soils especially on shaly slopes, and in such places it is frequently the commonest plant. It was the first plant to take possession of the freshly made embankments and cuttings along the Kalka-Simla Railway. Flowers: May—October.

POLYGONUM, *Linn.*—Perianth 4-5, rarely 3-cleft. Stigmas capitate. A very large genus containing many herbaceous species common in forest undergrowth in the Himalaya especially in rather moist places, ravines, etc. None of the indigenous species are shrubs as far as I have seen though several are described as shrubby.

RHEUM, *Linn.* (*The Rhubarb*).—Sepals 6, unchanged in fruit. Fruit winged. Several species of wild rhubarb are found in the inner Himalaya. The petiole of the leaves is eaten by Europeans but natives prefer to eat the leaf-blade as spinach.

ANTIGONUM LEPTOPUS, *Hook. and Arn.*—A large evergreen shrub climbing by means of tendrils; shoots somewhat quadrangular, softly pubescent. Leaves alternate, the lower 7 by 4 inches, the upper much smaller, ovate, acute, base cordate with rounded basal lobes, minutely pubescent especially on the nerves beneath, nerves impressed above prominent on the lower surface; petiole up to 1.5 inches long; stipules reduced to a raised line round the stem. Flowers .5 inch across, bright-pink, in large terminal panicles. Perianth-segments 5, the two inner smaller, the outer .4 inch long in flower,

ovate, accrescent and becoming more distinctly cordate in fruit. Stamens 8, filaments glandular, united in the lower half into a tube with interposed teeth. Styles 3, free; stigmas capitate. Nut 3-angled. *Coral creeper*.

Indigenous to South America. Cultivated in gardens and does well in the Sub-Himalayan tract but not so well in the plains. Flowers in the cold season.

MUEHLENBECKIA PLATYCLADOS, *Meissn.*—A glabrous straggling shrub about 2-4 feet high; branches flat, striate, often $\frac{1}{2}$ inch wide, appearing as if jointed. Leaves alternate, about 1 inch long, rhomboid or narrowly rhomboid-lanceolate, soon falling off. Flowers $\frac{1}{2}$ inch across, greenish-white, in small sessile clusters, arranged alternately at the nodes on the edges of the flattened twigs. Perianth-segments 5. Stamens 8-9, swollen and connate at the base and adnate to the base of the perianth-segments. Stigmas 3, fimbriate.

Indigenous to the Solomon Islands. Often cultivated especially as a pot plant. It does well in the Sub-Himalayan tract in moderate shade.

LXXV. PIPERACEÆ.

Herbs or shrubs. Leaves usually alternate; stipules 0 or 2, connate or adnate to the petiole. Flowers minute, 1-2-sexual, in axillary or terminal catkin-like spikes, each flower subtended by a peltate bract. Perianth 0. Stamens 2-6, rarely more, hypogynous, anthers often jointed on to the filaments, the cells sometimes confluent, dehiscing longitudinally. Ovary 1-celled or of 3 or more carpels, free or connate below; ovules 1 or more; stigmas sessile, simple or penicellate. Fruit small, of 1-celled genera indehiscent of the pluri-carpellar forming cocci or follicles. **DISTRIB.** Chiefly Tropical American.

PIPER, Linn.

(The Latin name for *pepper*, which is the fruit of *Piper nigrum*, Linn. **DISTRIB.** Species probably over 300; mostly in Tropical America and Asia.)

PIPER BRACHYSTACHYUM, *Wall. Cat.* (1828) No. 6656.—A rambling shrub; stems often very long, climbing on trees or rocks, swollen and rooting at the joints, branches terete, the lower warted. Leaves alternate, those on flowering stems 2-5 by 1-2 inches, ovate or elliptic, caudate-acuminate, entire, base narrowed, lateral nerves running longitudinally, the upper pair starting from above the base and reaching the apex, the middle pair starting from close above the base, the lowest pair often smaller than the rest; petiole $\frac{3}{4}$ inch long; stipules membranous, enclosing the buds; leaves of sterile climbing shoots 1-2 inches long, orbicular, pale beneath. Flowers 1-sexual, purple, diœcious. Spikes at the ends of the shoots, solitary, opposed to the uppermost leaf. Male spikes ovoid, $\frac{1}{2}$ inch long; peduncles $\frac{1}{2}$ inch long. Stamens 2; anthers reniform, dehiscing across the tip of the confluent cells. Female spikes similar to the males but slightly smaller. Stigmas 3, sessile, minute. Fruiting spikes shortly ovoid-cylindric or globose, $\frac{1}{2}$ inch long; berries $\frac{1}{4}$ inch diameter, 1-seeded, crowded.

Sub-Tropical Himalaya from the Sutlej eastwards, 2-5,000 feet. In the Fl. Brit. Ind., V, p. 87, the male spikes are described as being 2-3 inches long, slender and drooping, the description being taken from Nilgiri specimens as no Himalayan specimens showing the male flowers were then available. There are in Herb. Dehra two gatherings showing male spikes both from Tihri-Garhwal on which the description of the male spikes above given has been based. It seems that the specimens seen by Hooker were as he suggests mixed. More specimens showing male spikes should be collected and sent to herbaria. Flowers: May—June.

LXXVI. LAURACEÆ.

Trees or shrubs. Leaves alternate (rarely opposite), evergreen (rarely deciduous), entire (rarely toothed); stipules 0. Flowers regular, small, bisexual, rarely unisexual, variously arranged. Perianth usually inferior; tube short, sometimes enlarged in fruit; lobes 6 (rarely 4), in two series, the lobes of each series imbricate, rarely subvalvate, all similar and small. Stamens perigynous or epigynous, in 3-4 series, of which the innermost are generally reduced to staminodes, the inner or some or all the filaments often 2-glandular at the base, those of the two outer series opposite to the perianth-lobes; filaments flat; anthers adnate, 2- or 4-celled, dehiscing by upcurved valves. Ovary free, 1-celled; ovules solitary, pendulous, anatropous; style simple. Fruit a berry or drupe, naked or enclosed in or adnate to the perianth-tube; the stalk often thickened. **DISTRIB.** An important family of tropical and sub-tropical regions of the world but rare in Europe and Africa.

Flowers in panicles usually 2-sexual.

Leaves penninerved, alternate.

- | | | | |
|--|-----|-----|------------------------|
| Perianth-lobes linear or oblong, spreading
or reflexed in fruit | ... | ... | 1. <i>Machilus</i> . |
| Perianth-lobes elliptic, clasping the base of
the fruit | ... | ... | 2. <i>Phœbe</i> . |
| Leaves 3-nerved, often opposite | ... | ... | 3. <i>Cinnamomum</i> . |
| Flowers in clustered heads, 1-sexual... | ... | ... | 4. <i>Litsea</i> . |

1. MACHILUS, Nees.

(*Makelan* is the native name of one of the species in Amboyna; *makila*, in Leitimor.)

Evergreen trees. Leaves alternate, entire, coriaceous, clustered near the ends of the branches. Flowers bisexual, in axillary panicles. Perianth-tube short or obsolete; lobes of the outer series sometimes a little smaller than those of the inner, all persistent, reflexed in fruit. Stamens 9 perfect, those of the two outer series with eglandular filaments and introrse anthers, those of the third series with filaments which have 2 stipitate glands at the base and extrorse anthers, those of the fourth row reduced to stipitate cordate staminodes; anthers all 4-celled.

Ovary narrowed into the style; stigma discoid. Fruit a globose or ovoid berry supported by the persistent reflexed perianth. **DISTRIB.** Species 15-20; from India to Japan.

Panicles glabrous; fruit ellipsoid ... 1. *M. odoratissima*.

Panicles pubescent; fruit globose.

Leaves 5-10 inches long, lateral nerves 12-20

pairs ... 2. *M. Duthiei*.

Leaves 3-6 inches long, lateral nerves 6-9

pairs ... 3. *M. Gamblei*.

1. *MACHILUS ODORATISSIMA*, Nees, in Wall. Pl. As. Rar. II (1831) p. 70.—A small or medium-sized evergreen tree, twigs glabrous. Leaves 3-7 by 1-3 inches, very variable in shape, oblong, oblanceolate, elliptic-oblong or elliptic-obovate, acute or acuminate, base narrowed or rounded, bright-green and shining above, pale and glaucous beneath, glabrous, lateral nerves 7-13 pairs; petiole .3-1 inch long. Flowers .3 inch long, yellowish-green, in glabrous panicles 1.5-5 inches long, at first terminal but the shoot soon growing through the panicle leaving its branches below the leaves. Perianth-tube obsolete; lobes linear, glabrous or puberulous without, more or less villous at least towards the base within. Filaments villous near the base. Fruit .5-.7 inch long, ellipsoid, purple and pruinose when ripe. Vern. *Chán* (Haz. Rawalp.)

Sub-Himalayan tract from the Indus eastwards ascending to 6,000 feet. Not common in Hazara and Rawalpindi but found at low elevations and only in moist places, at the higher elevations it is replaced by the following species. The wood is grey, light, not hard, it is not used. Flowers: April.

2. *MACHILUS DUTHIEI*, King, ex Hook. f. in Fl. Brit. Ind. V (1890) p. 861.—A medium-sized evergreen tree, twigs glabrous. Leaves 5-10 by 1-2.5 inches, oblong or oblong-oblanceolate, acute or acuminate, usually gradually narrowed to the base, bright-green above, pale and glaucous beneath, glabrous; nerves 1-20 pairs; petiole .5-1 inch long. Flowers .3 inch long, yellowish-green, in pubescent panicles 2.5-5 inches long, appearing at the base of the young shoots below the leaves. Perianth-tube obsolete; lobes oblong, minutely silky pubescent on both sides. Filaments slightly villous at the very base. Fruit .3-.4 inch diameter, globose, black. Collett, Fl. Siml., fig. 138.

Himalaya 4-8,000 feet from the Indus eastwards. Not common; in moist shady ravines. This plant suffered considerably from frost in 1904-05 and in Rawalpindi and Hazara even large trees were killed to within a few feet of the ground. Wood grey, light, moderately hard, it is not used. Flowers: April,—May.

3. *MACHILUS GAMBLEI*, King, ex Hook. f. in Fl. Brit. Ind. V (1886) p. 138.—A medium-sized evergreen tree, young twigs

very minutely pubescent. Leaves 3-6 by .7-2 inches, rather variable, oblong, oblanceolate or elliptic-oblong, acuminate, gradually narrowed to the base, bright-green above, pale and glaucous beneath, glabrous; nerves 6-9 pairs; petiole .3-1 inch long. Flowers .25 inch long, yellowish-green, in pubescent panicles 1.5-4 inches long, appearing at the tips of the old or bases of the young shoots. Perianth-tube obsolete; lobes oblong, minutely silky pubescent on both sides. Filaments slightly villous at the base. Fruit .3-.4 inch diameter, globose, black. Vern. *Kharamb* (Ka.)

Along the base of the Himalaya in moist or wet places, from Chamba eastwards. Ascends to 4500 feet and possibly to greater elevations. Resembles *M. Duthiei* in its pubescent panicles and globose fruits but in foliage is more like *M. odoratissima*. It is found in wetter situations than the other two species. Flowers: April,—May.

2. *PHŒBE*, Nees.

(Phœbe in Greek mythology was the mother of Phœbus (Apollo; *Apolonias* is another genus of this family.) **DISTRIB.** Species about 50; Tropical Asia and America.)

PHŒBE LANCEOLATA, Nees, *Syst. Laurin.* (1836) p. 109.—A small evergreen tree, bark yellowish-white, young shoots slightly pubescent. Leaves alternate, crowded near the ends of the branches, 5-8 by 1-2 inches, oblong-lanceolate, caudate-acuminate, base narrowed, glabrous; petiole .4-.7 inch long. Flowers .1 inch long, yellowish-green, in lax axillary glabrous panicles shorter or longer than the leaves. Perianth cup-shaped, tube sub-obsolete; lobes elliptic, obtuse, all equal, pubescent within, enlarged and hardened in fruit. Stamens 9 perfect, those of the two outer series with eglandular filaments and introrse anthers, those of the third series with filaments which have 2 stipitate glands at the base and extrorse anthers, those of the fourth row reduced to stipitate cordate staminodes; anthers 4-celled; filaments slightly villous at the base. Fruit .3-.4 inch long, narrowly ellipsoid, black when ripe, half buried in the enlarged perianth.

Sub-Himalayan tract and outer hills ascending to 6,000 feet, in damp shady places, from the Kangra District eastwards. Not common. The growth is fast and the wood is hard and close-grained but is not used. The elliptic perianth-lobes distinguish *Phæbe* from *Machi'us* (in which the perianth-lobes are linear or oblong) when flowers only are available but they are very frequently confused. Flowers: February—June.

3. *CINNAMOMUM*, Blume.

(From *kinnamomon*, the Greek name used by Theophrastus and taken from the Arabic name *kinamon*. **DISTRIB.** Species about 130; Tropical and Sub-tropical Asia, Australia and Polynesia.)

CINNAMOMUM TAMALA, Nees & Eberm. *Med. Pharm. Bot.* II (1881) p. 426.—A small evergreen tree with thin dark-brown

smooth bark, glabrous except the inflorescence. Leaves opposite, sub-opposite and alternate on the same branch, 5-8 by 2-3 inches, ovate-lanceolate or -oblong, acuminate, the acumen often falcate, entire, coriaceous, somewhat shining above, glaucous beneath, 3-nerved from close above the base almost to the apex, pink when young; petiole .3-.5 inch long. Flowers .3 inch long, pale-yellowish, in axillary and terminal panicles about as long as the leaves, panicle-branches and pedicels hoary with minute grey silky hairs. Perianth-tube short, lobes 6, oblong, sub-obtuse, longitudinally nerved, silky pubescent, breaking off transversely below the middle after flowering. Perfect stamens 9, in 3 series, the outer 6 eglandular with introrse 4-celled anthers, the inner 3 with two glands at their base and extrorse 4-celled anthers, alternating with 3 cordate staminodes; filaments villous. Ovary free, villous, narrowed into the glabrous filiform style; stigma discoid. Drupe .5 inch long, black, ovoid, succulent, supported by the somewhat enlarged perianth-tube, which shows the truncate bases of the perianth-lobes on its margin. Vern. *Dilehni*.

Outer Himalaya in moist places 3-6,000 feet. Very scarce in the Punjab but has been collected in Suket State, District Kangra. The bark is used as a substitute for *Cinnamon* which is the bark of an allied species *C. zeylanicum*, Breyne. Flowers; May, June.

CINNAMOMUM CAMPHORA, Nees and Eberm.—A medium-sized evergreen tree; bark brown rough, twigs glabrous. Leaves alternate, 2-3.5 by 1.2 inches, elliptic or sometimes broadly ovate, acuminate, sometimes caudate, base narrowed into the petiole, glabrous, bright-green above, pale and glaucous beneath, more or less 3-nerved from or from a little above the base, nerves tumid in the axils on the lower surface of the blade; petiole .7-1 inch long, slender. Flowers .15 inch across, pale-yellowish, in slender glabrous axillary panicles about 1.5-2 inches long. Perianth 6-partite, lobes hairy within. Stamens 9 perfect, those of the third series with 2-glandular filaments, stamens of the fourth series reduced to cordate staminodes. Fruit .35 inch diameter, globose, seated on the thickened pedicel and cup-shaped base of the perianth. *Camphor Tree*.

Indigenous to China and Japan. Planted in gardens in the plains and in Abbottabad. Grows well in good soil, is quite hardy at 4,000 feet in Abbottabad and natural seedlings are occasionally found in gardens. Seedlings also spring up in moist shady places in the gardens in Lahore near the parent trees. In growing the Camphor tree from seed, fresh seed must be used as it soon loses vitality. The tree yields the *Japan Camphor*, a white crystalline substance which is used in the manufacture of celluloid and in smaller quantities for disinfectants, medicinal preparations and smokeless powder. The camphor is obtained together with an oil by steam distillation of the leaves, twigs or chips of wood. No attempt has been made on a commercial scale to grow Camphor in N.-W. India, but it has received a good deal of attention from planters in Malaya and Ceylon. The industry is not as yet of any great importance outside China, Japan and Formosa but if it ever becomes important in Ceylon or Malaya it could probably be established in the Himalaya as the tree could be grown easily in moist ravines at about 2-4,000 feet. Flowers: March.

4. *LITSEA*, Lamk.

(From the Japanese name of the genus.)

Trees or shrubs, evergreen, rarely deciduous. Leaves alternate, rarely opposite, penniveined or 3-nerved from the

base or from close above it. Flowers small, dioecious, usually umbellate, umbels usually 4-6-flowered, sessile or pedunculate, axillary or above the scars of fallen leaves; bracts involucrate, usually 4-6, concave, coriaceous or membranous. Perianth-tube ovoid, campanulate or very short; lobes usually 4 or 6, equal or unequal or wanting. Male-flowers; stamens 9 or 12 in 3-merous flowers, 6 in 2-merous flowers (by abortion sometimes fewer than 6, and in a few species more than 12); filaments of the first and second series usually eglandular, those of the third and fourth (if present) 2-glandular; anthers all 4-celled and introrse. Ovary minute, empty or obsolete (very rarely perfect). Female flowers; staminodes arranged as the stamens in the male flowers. Ovary free or enclosed in the perianth-tube; style short or long; stigma usually irregularly lobed. Fruit a drupe or berry resting on the unaltered perianth or clasped at the base by the often much enlarged discoid or cupular perianth-tube. **DISTRIB.** Species 140; Tropical Asia and Australia, rare in America and Africa.

Leaves penniveined; stamens 9 or more.

Leaves grey-tomentose beneath; fruit globose ... 1. *L. chinensis*.

Leaves brown-pubescent beneath or nearly glabrous; fruit ovoid.

Leaves elliptic, rounded at both ends ... 2. *L. polyantha*.

Leaves narrow-oblong, tapering at both ends 3. *L. elongata*.

Leaves 3-nerved; stamens 6.

Leaves 5-12 inches long; fruiting pedicels shorter than the fruit ... 4. *L. lanuginosa*.

Leaves 3-5 inches long; fruiting pedicels longer than the fruit ... 5. *L. umbrosa*.

1. *LITSEA CHINENSIS*, Lamk. *Encyc. Method.* III (1789) p. 574.—A small or medium-sized evergreen tree, bark dark-grey not rough; young parts grey-tomentose. Leaves very variable, alternate, 3-10 by 1·8-6 inches, elliptic, ovate or oblong-lanceolate, acute or acuminate, base usually narrowed, pubescent especially on the nerves above, more or less grey-tomentose beneath; petiole ·5-1·5 inches long, grey-tomentose. Flowers yellowish, small, in heads of about 8-12 flowers arranged in contracted pedunculate corymbs or umbels; common peduncle ·5-1 inch long; peduncles of the heads ·2-·5 inch long; heads globose in bud, about ·2 inch diameter, resembling flower-buds, each surrounded by an involucre of 4 rounded, concave, tomentose bracts; pedicels ·1 inch long, villous. Perianth-lobes very irregular, generally wanting; the tube silky. Stamens

up to 20 or more ; filaments clothed with long soft hairs ; glands with long stalks. Fruit globose, .3 inch diameter, black when ripe, supported by the thickened pedicel and base of the perianth. *L. sebifera*, Pers. Fl. Brit. Ind. V, p. 157. Vern. *Maidasák* (Rp.) *Rahan* (Ka).

Sub-Himalayan tract and adjacent plains from the Rawalpindi District eastwards. Salt Range. Not common. Occasionally cultivated and some forms are very different in appearance to the wild Punjab plant. It grows well in gardens in the plains and deserves to be more extensively planted. The wood is greyish-brown or olive-grey, moderately hard, seasons well, is durable and not attacked by insects. Flowers during the rains.

2. *LITSEA POLYANTHA*, Juss. in *Ann. Mus. Par.* VI (1805) p. 211.—A medium-sized evergreen tree, bark dark-grey, not rough ; young shoots brown-pubescent. Leaves alternate, 3-8 by 2-5 inches, elliptic or elliptic-oblong, usually rounded at both ends, glabrous above when mature, brown-pubescent and strongly reticulate beneath ; petiole .5-1 inch long, brown-pubescent. Flowers yellowish, small, in heads of about 5-6 flowers arranged in sessile or subsessile clusters ; peduncles of the heads .2-.5 inch long ; heads globose in bud, about .2 inch diameter, resembling flower-buds, each surrounded by an involucre of 5 rounded, concave, pubescent bracts ; pedicels .1 inch long or less, densely hairy, much elongated in fruit. Perianth .1 inch long, cleft nearly to the base ; lobes 5-6, oblanceolate-spathulate, membranous. Stamens 9-13 ; filaments hairy. Fruit .4 inch long ; ovoid, black when ripe, supported by the enlarged saucer-shaped perianth ; pedicels .4-.8 inch long, rather thick. Vern. *Ghián* (Ka).

Sub-Himalayan tract and adjacent plains from the Rawalpindi District eastwards. Salt Range. Not common. Wood olive-grey, soft, not durable, readily attacked by insects. Flowers usually March—April.

3. *LITSEA ELONGATA*, Wall. *Cat.* (1828) No. 2546.—A small evergreen tree, branchlets rusty-hairy. Leaves alternate, 3-6 by .8-1.7 inches, sometimes larger, narrowly oblong, oblanceolate or oblanceolate, acuminate, base narrowed, glabrous above, more or less hairy beneath, lateral nerves prominent on the lower surface ; petiole .3-.5 inch long, tomentose. Flowers yellowish, small, in heads of about 4-5 flowers ; heads solitary rarely clustered, males .5-.7 inch diameter in flower, female smaller ; peduncles of the heads usually very short and stout ; bracts coriaceous, rounded, concave, densely silky outside ; pedicels silky. Perianth .15 inch long ; lobes 4-6, membranous, oblong, obtuse. Stamens 8-12, filaments villous with long hairs. Fruit .5 inch long, ovoid, seated on the cup-shaped perianth-tube which is .3 inch across ; pedicels .3-.5 inch long, thick.

Himalaya 5-7,000 feet from the Kangra District eastwards. Not common. The only specimen I have seen was collected in the Kangra District and is in leaf only. Occurs also in Kulu (E. M. Coventry mss.) Flowers ; September.

4. *LITSEA LANUGINOSA*, Nees, *Syst. Laurin.* (1836) p. 634.— A medium-sized evergreen tree with large leaf-buds enclosed by brown-silky scales; bark brown, young shoots and leaves densely clothed with adpressed silky hairs. Leaves clustered at the ends of the branches (or at the end of the season's growth) 5-12 by 1·5-2·8 inches, oblong-oblongate or narrowly elliptic-oblong, acuminate, base narrowed, glabrous when mature, shining above, glaucous beneath, strongly 3-nerved from close above the base; petiole ·3-1 inch long. Flowers small, yellowish, in 4-flowered heads arranged in dense lateral sessile or subsessile clusters; pedicels of the female flowers about ·2 inch long, of the male rather shorter, silky. Perianth campanulate, villous outside; lobes 4, ovate, acute. Stamens 6; filaments of the inner series with long-stipitate glands. Fruit ·5-6 inch long, ovoid, on short thick pedicels ·2-3 inch long. *Tetradenia lanuginosa*, Wall.

Himalaya 2-4,000 feet from the Sutlej eastwards. Not common but has been collected at Suni on the Sutlej, and occurs in the Simla District near Kalka. Flowers: March, apparently also at other seasons.

5. *LITSEA UMBROSA*, Nees, *Syst. Laurin.* (1836) p. 623.— A small or medium-sized evergreen tree; bark smooth; young shoots and leaves pubescent. Leaves alternate, 3-5 by ·8-1·5 inches, oblong-elliptic, acuminate, base narrowed, glabrous when mature, pale and glaucous beneath, more or less 3-nerved from above the base; petiole ·5-·8 inch long. Flowers small, yellowish, in 6-12-flowered heads, arranged in dense sessile lateral clusters; pedicels about ·1 inch long, silky, much elongated in fruit. Perianth campanulate, villous outside; lobes 4, elliptic, obtuse. Stamens 6; filaments of the inner series with subsessile glands. Fruit ·4 inch long, subglobose, black when ripe, on pedicels ·5-·7 inch long. *Tetradenia umbrosa*, Nees. *T. consimilis*, Nees. *L. consimilis*, Nees. Collett, Fl. Siml. fig. 139. Vern. *Chirindi* (Ka).

Himalaya 4-8,000 feet from the Indus eastwards. This is the only member of the family common in the Punjab. It occurs in moist forests and in shady ravines. The wood is grey, darker when old, fairly hard, it is not used. The tree is usually about 20-25 feet in height and 3-4 feet in girth, occasionally larger. Flowers: March—May.

LAUREUS NOBILIS, Linn. — The well known *Bay-Laurel* of S. Europe and of European gardens is cultivated in Lahore and Abbottabad. It may be distinguished from all the indigenous species by its uniformly 2-celled anthers and 4-fid perianth. The flowers are dioecious and the tree is propagated by cuttings. Flowers: March.

LXXVII. PROTEACEÆ.

A family containing no indigenous plants but the following are cultivated:—

GREVILLEA ROBUSTA, A. Cunn. An evergreen tree. Leaves alternate, 6-12 inches long, pinnate; leaflets 6-12 pairs and a terminal one, entire or pinnati-

fid often so deeply so that the leaves appear bipinnate; ultimate lobes or segments linear-oblong, acute, margins recurved, dark-green above grey-silky beneath; stipules 0. Flowers orange, in racemes 3-4 inches long appearing from the old wood on dwarf leafless branches; pedicels .5 inch long, slender. Calyx 0. Corolla .5 inch long; tube .25 inch long, revolute, splitting down one side; limb ovoid, of 4 valvate segments, cohering long after the tube has opened. Anthers 4, sessile at the base of the concave corolla-segments. Disk semianular. Ovary 1-celled, stipitate; ovules 2; style filiform, protruding from the slit on the lower side of the corolla-tube before the tip is free, ultimately straightening, apex dilated; stigma conical. Fruit a follicle, .7 inch long .4 inch wide, oblong, compressed, oblique, tipped with the persistent style. Seed winged all round. *Silky Oak*.

Indigenous to Queensland. Frequently grown in gardens for its ornamental fern-like foliage. Young trees are very handsome but older specimens are invariably ragged and disappointing. It is remarkably hardy for a tree native of a tropical coast, growing well in the hills up to the winter snow-line, above this it suffers badly from snow-break but not from frost in an ordinary winter. The heartwood is durable and handsome, it is much used for cooperage in Australia. Flowers: March—April.

MACADAMIA TERNIFOLIA, *F. v. M.*—A small evergreen tree. Leaves in whorls of 3 or 4, sessile or nearly so, 3-12 inches long, narrowly oblong or lanceolate, glabrous, shining, entire or with small or large prickly teeth. Flowers .4 inch long, white, in racemes nearly as long as the leaves, Calyx 0. Corolla subregular. Stamens as in *Grevillea*. Disk annular. Ovary sessile; style long, straight; stigma small, terminal. Fruit globose, 1 inch diameter, indehiscent, exocarp thin fleshy, endocarp thick, woody, shining. *Queensland Nut*.

Indigenous to East Australia. Cultivated in Lahore but does not fruit very freely. It would probably do better in the Sub-Himalayan tract. The edible nuts are much appreciated in Australia. Flowers: April.

LXXVIII. THYMELÆACEÆ.

Shrubs or small trees, rarely herbs, with tough, silky-white bast fibres. Leaves alternate or opposite, simple, entire; stipules 0. Flowers usually bisexual and regular, in axillary or terminal heads, umbels or racemes. Perianth tubular or campanulate, usually corolline, frequently with a ring of scales or hairs at the mouth (representing petals?); lobes 4-5, imbricate. Stamens inserted on the perianth-tube, usually twice as many as its lobes, those of the outer series inserted opposite to the lobes and at a higher level than those of the inner series; anthers 2-celled, dehiscent longitudinally. Disk 0 or variously formed. Ovary usually 1-celled, superior; ovule 1, pendulous from the apex of the cell; style short or long; stigma various. Fruit usually a small berry, drupe or nut. **DISTRIB.** A small family most conspicuous in warm dry regions.

Leaves thick, glabrous or nearly so, alternate;
disk 0 or inconspicuous ... 1. *Daphne*.

Leaves thin, silky, often opposite; disk of 4
erect scales ... 2. *Wikstrœmia*.

1. DAPHNE, Linn.

(The Greek name of the Bay tree, *Laurus nobilis*.)

Shrubs or small trees. Leaves (in the Indian species) alternate, usually coriaceous. Flowers in terminal or lateral, sessile or peduncled, heads or clusters. Perianth-tube usually coralline, cylindric or somewhat widened at the base, persistent or deciduous; lobes 4, spreading. Stamens 8, biseriate; anthers subsessile. Disk 0 or obscure. Ovary 1-celled; style 0 or very short; stigma large, capitate. Drupe succulent or nearly dry. **DISTRIB.** Species about 40; Mediterranean, Temperate Asia.

Leaves not exceeding 2 inches long, sessile.

Leaves mucronate; perianth villous ... 1. *D. oleoides*.

Leaves obtuse, notched; perianth glabrous ... 2. *D. retusa*.

Leaves 2-5 inches long; petiole very short ... 3. *D. papyracea*.

1. DAPHNE OLEOIDES, Schreb. *Ic. Descr. Pl. Decad. I* (1766) p. 13, t. 7.—A much-branched shrub 4-8 feet high; young shoots clothed with short dense pubescence. Leaves 1-2 by 2-4 inch, oblong or linear, narrowed at both ends, mucronate, thick, glabrous, lateral nerves obscure, sessile. Flowers white or tinged with pink, in terminal, ebracteate, 3-9-flowered heads; pedicels minute. Perianth 4-7 inch long, grey-villous outside; lobes oblong, acute or subacute, shorter than the tube. Ovary densely hairy. Fruit ovoid, 3-4 inch long, orange or scarlet, enclosed when young in the perianth-tube. *D. mucronata*, Royle. Vern. *kuttildl* (Haz.).

Himalaya 3-9,000 feet from the Jumna westwards. Common in Kunawar, Chamba, Hazara and Trans-Indus. Rare or absent in the moister tracts. Flowers: April—September.

2. DAPHNE RETUSA, Hemsl. in *Journ. Linn. Soc. XXIX* (1892) p. 318.—An erect shrub, twigs rather stout, clothed when young with adpressed hairs. Leaves 1-5-2 by 5-7 inch, oblanceolate, narrowed towards the base, apex rounded, minutely notched, thick and rugose above when dry, glabrous, sessile. Flowers in terminal bracteate clusters of about 5-7; bracts oblong-spathulate, caducous; pedicels 0. Perianth glabrous; tube 3-4 inch long; lobes as long as the tube, oblique, broadly oblong, obtuse, emarginate. Ovary glabrous. Fruit not seen.

Himalaya 12-13,000 feet. Not common. I have seen the following specimens: Herb. Dehra (Saharanpur No. 22572), Musa, Muzaffarabad, Kashmir; Herb. Dehra No. 8338, Almora; Duthie No. 573, Nila Valley, Tihri-Garhwal (without flowers). Evidently an alpine species which should be looked for in the Punjab. Flowers: July.

3. DAPHNE PAPHYRACEA, Decne. in *Jacq. Voy. Bot.* (1844) p. 143, t. 148.—An evergreen shrub 5-8 feet high, young shoots tomentose soon becoming glabrous. Leaves 2-5 by 7-13 inches, narrowly elliptic-lanceolate or oblanceolate, narrowed

at both ends, thick, glabrous; petiole up to .2 inch long. Flowers white, in terminal bracteate heads; bracts .3-.7 inch long, oblong or lanceolate, caducous; pedicels minute. Perianth tube .3-.4 inch long, silky; lobes .2 inch long, ovate, acute, with a tuft of hairs at the tip. Ovary glabrous. Fruit ovoid, .4 inch long (black?). Under *D. cannabina*, Wall. in Fl. Brit. Ind. Collett, Fl. Siml., fig. 140.

Himalaya 5-10,000 feet from the Indus eastwards in forest undergrowth. Common. Flowers: March—May and September—November. For the reason for separating *D. papyracea* of the West Himalaya from *D. cannabina*, Wall. of the East, *vide* Smith and Cave "A note on the Himalayan species of *Daphne*" Rec. Bot. Surv. Ind. VI, 2 (1913), pp. 45-54.

2. WIKSTRÖEMIA, Endl.

(In honor of J. E. Wikström, a Swedish botanist of the 19th century. DISTRIB. Species 20; Eastern Asia, Australia and the Pacific Islands.)

WIKSTRÖEMIA CANESCENS, Meissn. in *Denkschr. Regensb. Bot. Ges.* III (1841) p. 288.—A slender erect deciduous shrub, young shoots hairy. Leaves opposite, sub-opposite or alternate, 1.5-3 by .6-1 inch, elliptic-oblong, thin, silky when young becoming glabrous except along the midrib beneath; petiole .1 inch long, hairy. Flowers yellow, in axillary and terminal heads or short spikes often forming small panicles; bracts 0. Perianth-tube .3 inch long, slender, silky outside; lobes 4, spreading, .15 inch long, obtuse. Stamens 8, biseriate, filaments short. Disk of 4 erect linear scales. Ovary 1-celled, villous; style short; stigma large, globose. Fruit .25 inch long, narrowly ovoid, enclosed at first in the perianth which ultimately splits and falls, black when ripe.

Himalaya 5-9,000 feet. Common in the inner valleys in the undergrowth of fairly dry deodar forests. Apparently absent in the outer moister tract. Kagan and Siran Valleys; Chamba; Bashahr. Also Trans-Indus. Yields a good fibre. Flowers: April—September.

LXXIX. ELÆAGNACEÆ.

Trees or shrubs, with copious silvery or brown stellate scales, sometimes with stellate hairs. Leaves alternate or opposite, entire; stipules 0. Flowers small, regular, bisexual or dioecious, white or yellow, in axillary fascicles or cymes. Perianth in female and bisexual flowers tubular, 2-6-cleft, constricted above the ovary, persistent in whole or in part; in male flowers of 2 membranous segments. Stamens in bisexual flowers inserted on the perianth-tube as many as its lobes and alternating with them, or twice as many; in male flowers adnate to the perianth-segments and double their number; filaments short, anthers 2-celled, dehiscing longitudinally; staminodes in female flowers 0. Ovary free, 1-celled; ovule solitary, basal; style filiform; stigma lateral. Fruit a false

drupe, the outer portion being composed of the base of the perianth which is fleshy when the seed ripens. **DISTRIB.** A small family of north temperate and tropical regions.

Flowers bisexual, perianth 4-fid ... 1. *Elæagnus*.

Flowers unisexual, usually diœcious; perianth
of the male-flowers 2-partite, of the female
2-fid ... 2. *Hippophaë*.

1. ELÆAGNUS, Linn.

(A classical name variously used for the Wild Olive and the Willow; applied to this genus owing to the resemblances in foliage. **DISTRIB.** Species estimated at 12 or about 27-35 according to the latitude allowed for the species; north temperate and tropical regions.)

ELÆAGNUS UMBELLATA, *Thunb. Fl. Jap.* (1784) p. 66, t. 14.—A deciduous shrub sparingly armed with short straight thorns; shoots and young branches clothed with silvery scales. Leaves alternate, 1-3 by .5-1 inch, elliptic-oblong, acute, acuminate or obtuse, base rounded or narrowed, dotted on the upper surface with stellate hairs when young, soon becoming glabrous, persistently silvery scaly beneath; petiole .2-.3 inch long, silvery. Flowers .4 inch across, dull yellowish-white, fragrant, appearing with the young leaves in few-flowered axillary clusters; pedicels .1-.15 inch long in flower, .2-.3 inch long in fruit, silvery. Perianth-tube .4 inch long, silvery-scaly outside, constricted above the ovary, tubular-funnel-shaped; lobes 4, ovate, acute, .15 inch long, valvate in bud. Stamens 4, inserted in the throat of the perianth-tube. Style included. Fruit .3 inch long, narrowly ovoid, succulent, covered with silvery scales; nut bony, ribbed. *Collett, Fl. Siml., fig. 141.* *Vern. Gehain (Bash.)*

Himalaya 3-10,000 feet. Common, especially in rather dry exposed places. The fruit can be eaten. Flowers: April—May.

ELÆAGNUS LATIFOLIA, *Linn.*—A large straggling or scandent shrub. Leaves usually 3-6 by 1.5-2.5 inches, clothed beneath with silvery or rusty scales. Flowers similar to those of *E. umbellata* but rather smaller. Fruit 1 inch long, ovoid-oblong, red or yellow.

Indigenous to the swampy parts of the Sub-Himalayan tract from the Jumna eastwards. Occasionally cultivated in gardens. The fruit is acid but can be eaten.

ELÆAGNUS HORTENSIS, *M. Bieb.*—Cultivated in the North-West Himalaya (Brandis, *Ind. Trees*, page 547). I have seen specimens from Pangi, Chamba State. It is found in Kashmir and Trans-Indus and is grown for its fruits which are .7 inch long, red and sweet when ripe. Differs from *E. umbellata* in having the leaves greyish on the upper surface with scattered scales and the free portion of the perianth-tube campanulate. It would probably do very well in Kagan or Kunawar and might be introduced.

2. HIPPOPHAE, Linn.

(From *Hippophæa*, the old Greek name for the prickly spurge, *Euphorbia spinosa*.)

Thorny shrubs. Leaves alternate, narrow. Flowers dioecious. Male-flowers sessile, clustered; perianth 2-partite almost to the base, lobes valvate. Stamens usually 4, rarely fewer by abortion, one-seriate, alternating with the angles of a small cushion-shaped disk. Rudimentary ovary 0. Female-flowers; shortly pedicellate, solitary; perianth-tube distinct, lobes 2, obscure. Stamens 0. Style filiform; stigma oblong-cylindric, oblique, exserted. Fruit orange or red, succulent, containing an utricle; seed oblong, testa crustaceous, shining. DISTRIB. Species 2; Europe and Temperate Asia.

Leaves clothed beneath with silvery or rusty

scales

1. *H. rhamnoides*.

Leaves clothed beneath with stellate hairs, the

midrib more or less rusty-scaly

2. *H. salicifolia*.

1. HIPPOPHAE RHAMNOIDES, Linn. *Sp. Pl.* (1753) p. 1023.—Very variable. The following forms are fairly distinct and represent perhaps more than one species.

Var. 1.—Twigs scaly, the scales distinct on the youngest shoots only, soon forming a silvery-waxy covering to the shoots. Leaves mostly 1.5-2 by .25 inch, upper surface green with scattered scales, lower densely silvery-scaly; petiole .1 inch long.

Himalaya 8-11,000 feet, in the dry inner valleys. Lahaul. Along the banks of streams. This is the form most like the *Sea Buckthorn* of Europe.

Var. 2.—Twigs as in the above. Leaves 1 inch long or less, .15 inch wide, grey above with silvery scales, densely scaly beneath; petiole obscure.

Himalaya 8-11,000 feet, in the inner dry valleys. Kunawar. A smaller and more thorny shrub than the above, probably not specifically distinct.

Var. 3.—Twigs rusty-scaly when young, soon becoming dull-black. Leaves .7 by .15-.2 inch, rusty-scaly on both sides but especially on the lower; petiole 0. Perianth of the male flowers almost free from scales.

Himalaya 11-14,000 feet. Kunawar to Kumaon. This appears to be a distinct species. It is a dwarf shrub, thorns few, usually terminating slender flexible shoots. Flowers just before the young foliage appears in spring.

2. HIPPOPHAE SALICIFOLIA, D. Don, *Prodr. Fl. Nep.* (1825) p. 68.—A deciduous shrub or small tree, shoots rusty-scaly. Leaves 1.5-4 by .3-.6 inch, oblong-lanceolate, cottony-pubescent above when young with stellate hairs, velvety beneath with a dense soft tomentum of white stellate hairs, midrib scaly; petiole about .1 inch long. Perianth of the male-flowers scaly.

Himalaya 7-11,000 feet. Kunawar, Kumaon. Along the banks of streams in the inner Himalaya. Somewhat larger than *H. rhamnoides* as a rule and not so common in the drier parts where it is replaced by

H. rhamnoides. Reaches 20 feet in height in favorable places and has the general appearance of a willow. Flowers just before the young leaves, about May—June.

LXXX. LORANTHACEÆ.

Parasitic shrubs, usually growing on the branches of other plants. Leaves usually opposite, entire, thick, sometimes absent; stipules 0. Flowers 1-2-sexual, in axillary racemes, fascicles or spikes, rarely terminal, usually bracteate and often 2-bracteolate. Perianth simple or double. Calyx or simple perianth when sepaloid, adnate to the ovary; limb annular or cupular, entire or shortly toothed. Petals or simple perianth-segments when petaloid, 3-6 (rarely 2), valvate, free or more or less connate into a tube which is perfect or slit on the upper side. Stamens as many as and opposite to the petals or perianth-segments, free or united to them. Disk epigynous or in male flowers intrastaminal or 0. Ovary inferior, usually apparently solid with the ovules and placenta not differentiated; style and stigma various. Fruit a berry or drupe, usually replete with viscid mucous. Seeds usually solitary. **DISTRIB.** A fairly large family, mainly tropical.

Flowers bisexual, showy; leaves opposite or alternate 1. *Loranthus*.

Flowers unisexual, inconspicuous.

Leaves opposite, 3-5-nerved or 0; anthers opening by pores ...

2. *Viscum*.

Whole plant very minute and inconspicuous, only the flowers showing or plant conspicuous, jointed, the joints ending in a truncate sheath which represents the leaves; anthers opening transversely ...

3. *Arceuthobium*.

1. LORANTHUS, Linn.

(From the Greek *loron*, a strap, and *anthos*, a flower; referring to the shape of the petals.)

Leaves opposite or alternate, often in the same species. Flowers 2-sexual. Calyx adnate to the ovary and often produced beyond it. Petals 4-6, free or more or less connate into a tubular corolla with spreading lobes. Stamens inserted on the petals; anthers usually adnate, cells parallel. **DISTRIB.** Species about 300; very few extra-tropical.

These parasites do no appreciable damage to trees in the Punjab. Many species, if not all, attack a very large number of trees, but show a preference to certain kinds. Vern. *Bānda*, *bāna*, *parind*, *pand*.

Flowers and young leaves tomentose (in *L. pulverulentus* the leaves soon become glabrous).

Flowers in fascicles.

Buds sharply pointed ...

1. *L. cordifolius*.

Buds blunt ...

2. *L. vestitus*.

Flowers in racemes ...

3. *L. pulverulentus*.

Flowers and leaves glabrous or nearly so.

Flowers 4-merous.

Corolla 4-lobed ; leaves obtuse or cordate
at the base 4. *L. elatus*.

Petals 4 ; leaves lanceolate, base acute... 5. *L. ligustrinus*.

Flowers 5-merous 6. *L. longiflorus*.

1. *LORANTHUS CORDIFOLIUS*, Wall. in Roxb. *Fl. Ind. ed. Carey*, II (1824) p. 223.—Young leaves and shoots clothed with buff-colored tomentum. Leaves opposite, variable, usually 2-4 by 1·5-3 inches, broadly ovate or suborbicular, obtuse, base rounded or subcordate, glabrous when mature ; petiole ·3-·6 inch long. Flowers ·7-1 inch long, in tomentose fascicles or short racemes ·5 inch long or less, corolla green outside, crimson inside, style and filaments crimson ; buds sharply pointed ; pedicels ·1 inch long. Calyx scarcely produced above the ovary. Corolla tomentose outside, slender, curved ; lobes 4, acute, reflexed. Berry ·3 inch long, pyriform, scurfy.

Sub-Himalayan tract from Kashmir eastwards ascending to 5,000 feet. On *Platanus*, *Quercus dilatata*, *Phyllanthus Emblica*, *Citrus*, &c. Flowers : November—January.

2. *LORANTHUS VESTITUS*, Wall. in Roxb. *Fl. Ind. ed. Carey*, II (1824) p. 218.—Shoots, petioles and leaves beneath clothed with dense soft tomentum. Leaves opposite, 2-4 by ·8-1·5 inches, lanceolate or ovate-lanceolate, narrowed at both ends, margins recurved ; petiole ·3-·6 inch long. Flowers ·6 inch long, in axillary villous fascicles, the fascicles usually very shortly peduncled, peduncles usually clustered ; buds clavate, obtuse ; pedicels 0. Calyx scarcely produced above the ovary. Corolla tomentose outside, curved ; lobes 4, obtuse. Berry ·4 inch long, ellipsoid, ferruginous. Collett, *Fl. Siml.*, fig. 142.

Outer Himalaya ascending to 8,000 feet, from Chamba eastwards. Common on *Quercus dilatata* and *incana*, *Machilus*, &c. Flowers : October—January.

3. *LORANTHUS PULVERULENTUS*, Wall. in Roxb. *Fl. Ind. ed. Carey*, II (1824) p. 221.—Shoots and young leaves clothed with white flocculent fugacious mealy tomentum, soon becoming glabrous. Leaves opposite, 3-5 by 1·5-3 inches, ovate or ovate-oblong, usually sub-acute, base rounded or narrowed into the petiole ; petiole ·5-·8 inch long. Flowers 1 inch long, green, style and filaments crimson, in scurfily white-tomentose racemes which are solitary or fascicled, ·5-2·5 inches long ; buds curved, sub-acute, the tubular portion broader than the limb ; pedicels ·15-·2 inch long. Calyx scarcely produced above the ovary.

Corolla tomentose outside, curved; lobes 4, reflexed. Berry .3 inch long, obconic, mealy.

Sub-tropical Himalaya 2-4,000 feet, from the Ravi, Sutlej and Jumna Valleys eastwards to Bhotan. On *Mallotus philippinensis* and *Dalbergia Sissoo*. Usually readily distinguished from *L. cordifolius*, but the short-racemed specimens are somewhat similar. The plant as regards the leaves and shoots is however glabrous except when quite young and the flower buds are less slender and much less sharply pointed. Flowers: August October and March, April (possibly all the year round). This species sends aerial roots which run along the branches of the host attaching themselves at intervals by means of haustoria.

4. *LORANTHUS ELATUS*, Edgew. in *Trans. Linn. Soc. XX* (1846) p. 58.—Youngest shoots and leaves pubescent. Leaves opposite and alternate, 2.5-5 by 1.5-3 inches, broadly ovate, acute, base rounded or subcordate, glabrous when mature; petiole .3-.5 inch long, very stout. Flowers 1-1.5 inches long, red and green, in short axillary fascicles or racemes .7 inch long or less; peduncle or rachis stout, glabrous or slightly rusty; pedicels .2 inch long, puberulous; buds cylindric, scarcely clavate, blunt. Calyx rusty-pubescent, limb obscure. Corolla hoary when young, curved, lobes 4. Berry .3 inch long, turbinate, glabrous.

Temperate Himalaya 5-10,000 feet, from the Sutlej eastwards. On Rosaceous fruit trees, *Populus ciliata*, *Viburnum cotinifolium*, &c. Resembles *L. pulverulentus*, but the inflorescence is nearly glabrous and the leaves are alternate or inconstantly opposite. Flowers: June—July.

5. *LORANTHUS LIGUSTRINUS*, Wall. in *Roxb. Fl. Ind. ed. Carey*, II (1824) p. 219.—Youngest shoots and inflorescence slightly rusty-pubescent. Leaves inconstantly opposite, 1.5-3.5 by .5-1.2 inches, lanceolate, narrowed at both ends, glabrous; petiole .2-.3 inch long. Flowers .4 inch long, in short axillary racemes which are solitary or paired, 1 inch long or less, often reduced to a single pair of flowers on a peduncle .2 inch long; buds cylindric, obtuse; pedicels .05 inch long. Calyx-limb very short, truncate. Corolla of 4 distinct ligulate petals, puberulous outside, reflexed from the middle. Berry .25 inch long, ovoid.

Sub-Himalayan tract ascending to 4,000 feet, from the Kangra District eastwards. Occurs on a great variety of trees especially on *Mallotus philippinensis*. Flowers: April—June.

6. *LORANTHUS LONGIFLORUS*, Desrouss. in *Lamk. Encyc. Method.* III (1789) p. 598.—Glabrous. Leaves inconstantly opposite, 3-10 by .7-5 inches, very variable in shape, ovate, elliptic or oblong, obtuse, base usually narrowed; petiole .3-.7 inch long. Flowers 1-2 inches long, usually scarlet, in dense racemes; rachis stout, 1-2.5 inches long; buds cylindric, acute; pedicels .1-1.5 inch long, secund. Calyx produced above the ovary, truncate

or wavy. Corolla glabrous, curved, lobes 5, green. Berry .3-.5 inch long; ovoid-oblong, crowned with the cup-shaped calyx-limb.

Himalaya ascending to 6,000 feet, Sub-Himalayan tract and adjacent plains from the Rawalpindi District eastwards. The commonest and most conspicuous species growing on a great variety of trees especially on *Albizia Lebbek*. Flowers more or less all the year round.

2. VISCUM, Linn.

(The Latin name for the Mistletoe, used by Virgil and Pliny.)

Leaves opposite, flat and thick or reduced to minute scales or teeth. Flowers small or minute, unisexual, usually fascicled in the axils or at the nodes; bracts usually small, bracteoles usually 2, free or connate. Perianth-tube in the male flowers short or solid; in female flowers adnate to the ovary; limb 3-4-lobed, lobes deciduous or persistent. Anthers broad, sessile on the perianth-lobes, dehiscing by many pores. Ovary inferior; stigma sessile or subsessile, large, cushion-shaped. Berry succulent, pericarp replete with viscid mucous. **DISTRIB.** Species about 30; temperate and tropical.

Leafy: stems terete ... 1. *V. album*.

Leaves 0; stems flattened, jointed.

Joints 1-2 inches long, striate ... 2. *V. articulatum*.

Joints .2-.6 inch long, not striate ... 3. *V. japonicum*.

1. **VISCUM ALBUM**, Linn. *Sp. Pl.* (1753) p. 1023.—Yellowish-green, bushy, forming tufts 2-3 feet diameter; stems terete, branches jointed, dichotomous. Leaves variable, usually 1-2 inches long, oblong, broad or narrow, usually with obtuse tip and cuneate base, glabrous, thick and fleshy, obscurely 3-5-nerved, sessile. Flowers dicæious, sessile, in clusters of 3 or 5 in the forks of the branches, supported by cup-shaped slightly ciliate bracts; terminal flower solitary, the lateral in opposite or decussate pairs. Perianth-segments 3-4, triangular, thick, acute, deciduous. Berry .3 inch diameter, subglobose, white, translucent. *The Mistletoe*.

Himalaya 3-9,000 feet. Common. Chiefly found on Rosaceous trees and shrubs and cultivated fruit trees and on the Walnut; less commonly on a great variety of other trees. The Mistletoe and probably all species of *Loranthus* are spread by birds which eat the fruits and in doing so get the seed struck to their bills by the sticky pulp. The seeds are wiped off on twigs of trees where the pulp adhering to them dries and holds the seeds to the twig where they germinate. In the case of the Mistletoe, the root on germination turns towards the stem and forms an adhesive disk from the under-surface of which a haustorium is formed which penetrates the bark to the surface of the wood where it spreads. As the stem or twig on which the Mistletoe is growing thickens, the roots of the parasite become embedded in the tissue of the host. The branches on which Mistletoe is growing swell up at the point from which the parasite arises and become irregularly thickened, but are

not killed at any rate not for many years and as the main stem is very rarely attacked the damage done is usually inconsiderable. Considerable quantities are collected and sent to hill stations and also to the plains for the decoration of European houses at Christmas time. Flowers: March—May; berries ripen in November remaining long on the plant. Polyembryony is of common occurrence.

2. *VISCUM ARTICULATUM*, *Burm. Fl. Ind.* (1768) p. 311.—Green, leafless, forming pendulous tufts 6 inches to 3 feet long; stems flattened, jointed, joints 1-2 inches long, $\cdot 2\text{--}\cdot 4$ inch broad, longitudinally ribbed, widened slightly from the base upwards. Flowers monœcious, sessile, in clusters of 3 at the nodes, the lateral flowers usually male; bracts cup-shaped. Perianth-segments triangular, erect in female, spreading in male flowers, deciduous. Berry $\cdot 2$ inch diameter, globose, yellow when ripe. Collett Fl. Siml., fig. 143 (this figure being $\frac{1}{2}$ to $\frac{1}{3}$ natural size is not unlike *V. japonicum*).

Outer Himalaya from the Sutlej eastwards ascending to 6,000 feet. Not common. Found on a great variety of plants. Flowers: June—October.

3. *VISCUM JAPONICUM*, *Thunb. in Trans. Linn. Soc. II* (1793) p. 329.—Green, leafless, forming nearly erect dense tufts 6 inches long or less; stems flattened, jointed; joints $\cdot 2\text{--}\cdot 6$ inch long, $\cdot 1\text{--}\cdot 2$ inch wide, much contracted towards the base. Flowers as in *V. articulatum* but segments of the perianth persistent. Berry $\cdot 1$ inch long, ellipsoid, white.

Himalaya ascending to 8,000 feet. Common on *Quercus incana* and *dilatata* throughout the Punjab Himalaya and on *Quercus Ilex* Trans-Indus and in Kunawar. Flowers: May—July.

3. *ARCEUTHOBIMUM*, M. Bieb.

(From the Greek *arceuthos*, the juniper, and *bios*, life; the first species described is a parasite of the juniper.)

Leafless, branches articulate. Joints fleshy, ending in a minute cup-shaped sheath which encloses the base of the next joint. Flowers minute, diœcious. Male flowers; perianth 2-5-partite; anthers sessile, 1-celled, dehiscing by a transverse slit. Female flowers; perianth 2-fid; style short, conical; stigma blunt. Berry ultimately dehiscing elastically. **DISTRIB.** Species 9; parasitic on conifers in the Northern Hemisphere.

1-5 inches long; parasitic on *Juniperus mac-*

ropoda ...

1. *A. Oxycedri*.

Minute, up to $\cdot 2$ inch long; parasitic on *Pinus*

excelsa ...

2. *A. minutissimum*.

1. *ARCEUTHOBIMUM OXYCEDRI*, M. Bieb. *Fl. Taur. Cauc. III* (1819) p. 629.—Tufted, 1-5 inches long. Joints up to $\cdot 2$ inch long, sheaths truncate. Fruit less than $\cdot 1$ inch long, seed cylindric, embedded in viscid mucous and ejected with great force when the fruit is ripe.

Lahaul 9-11,000 feet. On *Juniperus macropoda*. This plant is perhaps much commoner than supposed as it might easily be overlooked. It produces long roots between the bark and wood of its host and gradually overspreads the plant which may in time be killed by the parasite. Flowers : April (in Europe) fruit ripens 14 months later.

2. *ARCEUTHOBium MINUTISSIMUM*, Hook. f. in *Fl. Brit. Ind.* V (1886) p. 227.—Usually very minute and appearing as small green pustules on the bark of its host, rarely up to .2 inch long ; joints .05 inch long, sheaths minute, 2-toothed. Flowers terminating branches which pierce the bark and appear as minute 2-lipped cups. Male flowers sessile in the cup ; perianth 3-5-partite. Female flowers pedicelled ; perianth minutely 2-fid. After flowering the branch beneath the fruit elongates so that the berries are borne on minute shoots composed of about 2 joints. Berry .1 inch long, ovoid, tipped by the persistent perianth.

Himalaya 6-12,000 feet, from the Indus eastwards. Common. Occasionally does considerable damage killing off the tops of blue pine saplings for some 6 feet. On trees so killed the parasite also dies but remains recognizable appearing as pustules dotted closely over the bark. It appears to be on the increase and it may become necessary to take measures against it. I have seen damage done only to saplings and then only when the main stem is attacked. It does not appear able to attack older stems protected by thick rough bark. Nothing is known of the details of the life history but the plant is presumably spread by the ripe fruit bursting and ejecting the sticky seeds. The smallest dicotyledonous plant. Flowers : June—September.

LXXXI. SANTALACEÆ.

Trees, shrubs or herbs, probably all parasites or semi-parasites. Leaves opposite or alternate, entire, sometimes scale-like or 0 ; stipules 0. Flowers 1-2-sexual, green, small, regular, usually bracteate and bracteolate. Perianth superior or inferior, 3-8-lobed, lobes usually valvate. Stamens as many as the perianth-lobes, inserted on and opposite to them ; anthers 2-celled, dehiscing lengthwise. Disk epigynous or perigynous. Ovary 1-celled, usually inferior ; ovules 1-3, hanging from the apex of a central columnar placenta. Fruit a nut or drupe, seed usually solitary without testa, embryo small in copious fleshy albumen. **DISTRIB.** A small family of tropical and temperate regions.

OSYRIS, Linn.

(The Greek name of a plant supposed to have been dedicated to the *Osiris* mentioned in the writings of Dioscorides. **DISTRIB.** Species 6 ; S. Europe, Africa, E. Asia.)

OSYRIS ARBOREA, Wall. *Cat.* (1828) No. 4935.—An ever-green twiggly shrub 5-10 feet high, shoots sharply 3-angled. Leaves alternate, 1-2 by .5-1 inch, very variable in shape, elliptic-lanceolate or obovate-oblong, obtuse or acute, mucronate, base cuneate, dull glaucous green, sessile. Flowers minute, greenish, polygamous ; male in axillary 5-10-flowered umbels,

peduncles .3-.5 inch long, flattened, often arranged in short racemose panicles; bisexual solitary on slender axillary pedicels .2 inch long, lengthening in fruit. Perianth-tube solid in male, adnate to the ovary in bisexual flowers, limb 3-lobed, lobes triangular, valvate. Stamens inserted at the base of the perianth-lobes. Disk fleshy, 3-lobed, the lobes alternating with the stamens. Ovary sunk in the perianth-tube, 1-celled; ovules 2-4; style short; stigma 3-lobed. Drupe .3 inch diameter, sub-globose, nearly dry, crowned by the disk, red when ripe. Collett, Fl. Siml., fig. 144.

Himalaya ascending to 6,000 feet and Sub-Himalayan tract from the Kangra district eastwards. Not common. A root parasite similar to the Sandal. Flowers more or less all the year round.

LXXXII. EUPHORBIACEÆ.

Herbs, shrubs or trees, often with milky juice. Leaves alternate or opposite, usually simple, usually stipulate. Flowers unisexual, usually small or minute. Perianth simple and calycine, rarely petaloid or double, often wanting in one or both sexes. Stamens 1-numerous, free or connate; anthers 2-celled. Ovary superior, as a rule of 3 carpels more or less united; ovules 1-2 in each carpel, pendulous from the inner angle; styles as many as carpels, free or connate, usually stigmatose on the inner face. Fruit usually a 3-valved capsule, sometimes a drupe. Seeds often with a thickening at the hilum. **DISTRIB.** A large family chiefly tropical.

Key to the genera from leaves.

- | | | | | | | |
|---|---|---|-----|-----|-----|-----------------------|
| 1 | { | Stems and leaves if present fleshy, juice copious | ... | ... | ... | 1. <i>Euphorbia</i> . |
| | | milky | ... | ... | ... | |
| | { | Stems not fleshy | ... | ... | ... | 2. |
| 2 | { | Leaves alternate | ... | ... | ... | 4. |
| | | Leaves opposite | ... | ... | ... | 3. |
| 3 | { | Leaves thick, evergreen, penninerved, 1-3 inches long | ... | ... | ... | 3. <i>Buxus</i> . |
| | | Leaves thin, deciduous, 3-5 basal nerves, 6-9 inches long | ... | ... | ... | 4. <i>Trewia</i> . |
| 4 | { | Leaves simple | ... | ... | ... | 5. |
| | | Leaves compound, trifoliate | ... | ... | ... | 2. <i>Bischofia</i> . |
| 5 | { | Leaves not peltate | ... | ... | ... | 6. |
| | | Leaves peltate, palmately 7-many-lobed | ... | ... | ... | 18. <i>Ricinus</i> . |
| 6 | { | Leaves closely dotted beneath with minute red glands | ... | ... | ... | 14. <i>Mallotus</i> . |
| | | Leaves without red glands | ... | ... | ... | 7. |

- 7 { Leaves penninerved ... 9.
 { Leaves with 3, 5 or 7 strong basal nerves ... 8.
- 8 { Twigs very stout, leaves soft, glabrous ... 17. *Jatropha*.
 { Twigs not markedly thick, leaves hard, pubescent except when old ... 16. *Baliospermum*.
- 9 { Leaves more than 1 inch long ... 11.
 { Leaves not usually over 1 inch long (if some are a little over 1 inch then plant thorny) ... 10.
- 10 { Trees or shrubs, unarmed ... 8. *Phyllanthus*.
 { A thorny shrub ... 11. *Flueggea*.
- 11 { Leaves over 4 inches long ... 12.
 { Leaves not over 4 inches long ... 15.
- 12 { Twigs very stout, juice milky, leaves crenate-serrate ... 15. *Sapium*.
 { Not as above, leaves entire or wavy at most ... 13.
- 13 { Lateral nerves 8 or more pairs, conspicuous ... 14.
 { Lateral nerves obscure ... 7. *Antidesma*.
- 14 { Petiole 1-2 inches long ... 6. *Daphniphyllum*.
 { Petiole .5 inch long or less ... 5. *Bridelia*.
- 15 { A tree, softly tomentose or pubescent all over ... 12. *Glochidion*.
 { Glabrous or nearly so (rarely young shoots tomentose) ... 16.
- 16 { Lateral nerves 8 or more pairs, very conspicuous ... 5. *Bridelia*.
 { Lateral nerves slender, not markedly prominent ... 17.
- 17 { Leaves rhomboid, acuminate; petiole 1-2 inches long ... 15. *Sapium*.
 { Not as above ... 18.
- 18 { Leaves shiny above, green beneath ... 19.
 { Leaves dull-green above, often glaucous or pale beneath ... 20.
- 19 { A tree, leaves obtuse or shortly pointed ... 9. *Putranjiva*.
 { A shrub, leaves long pointed ... 10. *Sarcococca*.
- 20 { Leaves somewhat thick, mostly acuminate ... 7. *Antidesma*.
 { Leaves thin, obtuse or sub-acute ... 21.
- 21 { Leaves pubescent beneath, petiole very slender ... 13. *Andrachne*.
 { Leaves glabrous, glaucous and reticulate beneath ... 11. *Flueggea*.

Alternative key to the genera.

- A. — Flowers monœcious, males reduced to a solitary pedicelled stamen. Branches fleshy, juice milky 1. *Euphorbia*.
- B. — Stamens more than 1. Branches not fleshy.
- I. — Leaves trifoliolate ... 2. *Bischofia*.
- II. — Leaves simple.
- (a) Leaves opposite.
- Flowers monœcious, leaves coriaceous ... 3. *Buxus*.
- Flowers dioecious, leaves membranous ... 4. *Trewia*.
- (b) Leaves alternate.
- (i) Fruit a drupe or berry.
- Petals 5, small; filaments 5, united in a column ... 5. *Bridelia*.
- Petals 0.
- Male flowers in spikes or racemes 1 inch or more in length.
- Flowers of both sexes in thick fleshy spikes ... 15. *Sapium*.
- Flowers of both sexes in racemes.
- Petioles 1-2 inches long ... 6. *Daphniphyllum*.
- Petioles 2 inch long or less ... 7. *Anidesma*.
- Male flowers in clusters or very short racemes.
- Fruit more than 5 inch long.
- Leaves less than 1 inch long ... 8. *Phyllanthus*.
- Leaves over 2 inches long ... 9. *Putranjiva*.
- Fruit less than 5 inch long.
- Leaves lanceolate; flowers monœcious ... 10. *Sarcococca*.
- Leaves broad-ovate to orbicular or obovate; flowers dioecious ... 11. *Flueggea*.
- (ii) Fruit a capsule or ultimately dehiscent.
- Leaves not peltate.
- Petals 0.
- Flowers in clusters.
- More or less tomentose all over 12. *Glochidion*.
- Glabrous or nearly so.
- Petiole not exceeding 5 inch long.
- Stamens 3, pistillode 0 ... 8. *Phyllanthus*.
- Stamens 5, pistillode 3-fid 11. *Flueggea*.
- Petiole exceeding 5 inch long 16. *Batispermum*.
- Flowers in spikes or racemes.
- Leaves dotted beneath with minute red glands ... 14. *Mallotus*.
- Leaves not gland-dotted.
- Glabrous, racemes or spikes long terminal ... 15. *Sapium*.

Pubescent except when old, racemes short axillary ... 16. *Baliospermum*.

Petals present.

Flowers in small clusters, pedicels capillary ... 13. *Andrachne*.

Flowers in cymose panicles 2-5 inches long ... 17. *Jatropha*.

Leaves peltate ... 18. *Ricinus*.

1. EUPHORBIA, Linn.

(From the *Euphorbion* of Dioscorides one of this genus, so called after Euphorbus, a physician of Juba, king of Mauritania, who first made known the medicinal properties.)

Herbs, shrubs or small trees, the latter with fleshy branches armed or not and copious milky juice. Leaves opposite or alternate. Flowers monœcious, in heads resembling single flowers, consisting of a calycine cup-shaped involucre the margin of which is 4-5-lobed, the lobes alternating with swollen fleshy glands which sometimes develop a petaloid limb, enclosing 10-15 male and 1 central female flower. Male flowers; a naked pedicelled stamen. Female flowers; a stipitate 3-celled ovary; ovules solitary in each cell; styles 3, free or connate, simple or 2-fid. Fruit a capsule separating elastically from a persistent axis into 3 two-valved cocci. **DISTRIB.** Species about 600; all regions except the Arctic.

Branches very stout, armed with pairs of stipular spines.

Branches with 5 longitudinal ridges ... 1. *E. Royleana*.

Branches with 5 more or less spirally twisted ridges ... 2. *E. nerifolia*.

Branches round with spirally arranged tubercles ... 3. *E. Nivulia*.

Branches cylindric unarmed ... 4. *E. Tirucalli*.

1. *EUPHORBIA ROYLEANA*, Boiss. in *DC. Prodr.* XV, ii (1862) p. 83.—A shrub or small tree; branches whorled, about 2 inches diameter, 5-7-angled the ridges wavy with a pair of stipular spines 2-3 inch long at the crest of each wave. Leaves alternate, 4-6 inches long, spatulate, mucronate, very thick and fleshy, sessile. Involucres 5 inch across, yellow, in compact sessile 3-flowered cymes arising from the sinus between the nodes. Capsule 6 inch diameter, pale-grey, 3-lobed, pedunculate. Vern. *thor* (a name used for any fleshy leafless cactus-like plant).

Himalaya ascending to 6,000 feet from the Indus to Kumaon. Salt Range. Common on dry rocky hot slopes. Reaches 15 feet in height and 5-6 feet in girth. The branches are whorled and the crown often so dense as to cast a perfect shadow. Commonly grown in hedges in the Sub-Himalayan tract and adjacent plains. Grows readily from cuttings as do the following

species but the cuttings should be planted in the hot weather, not during the rains. Cuttings are often used to protect young roadside trees, road embankments, etc. The leaves appear during the rains and fall soon afterwards, but remain till the cold weather on specimens grown in moist or shady places. Wood white, soft, spongy, perishable. Flowers in the hot weather.

2. *EUPHORBIA NERIIFOLIA*, Linn. Sp. Pl. (1753) p. 451.—A shrub or small tree; branches whorled, about 2 inches diameter, with 5 rows of sub-confluent tubercles which form undulate spiral ridges, each tubercle bearing a pair of sharp conical stipular spines. Leaves alternate, 6-12 inches long, oblanceolate, thick and fleshy. Flowers as in the following. *E. ligularia*, Roxb.

Cultivated in hedges in the Kangra District and occasionally seen elsewhere. Not wild in the Punjab, or in the Central Provinces or Bengal. It is said to be wild in the Deccan. Reaches 6-15 feet in height. Flowers during the hot weather.

3. *EUPHORBIA NIVULIA*, Buch-Ham. in Trans. Linn. Soc. XIV (1825) p. 286.—A shrub or small tree; branches whorled, about 1-1.5 inches diameter, round with pairs of sharp stipular spines arising from low conical spirally arranged distant tubercles. Leaves alternate, 4-9 inches long, obovate to spatulate, apex rounded or retuse, very thick and fleshy, sessile. Involucres yellow, 3-nate, forming small shortly pedunculate cymes arising from above the leaf-scars.

Dry arid rocky hills in the extreme S. E. Punjab. Abundant in Jaipur State, Rajputana. Reaches 30 feet in height and 3-4 feet in girth with a very rough thick bark. These arborescent specimens have rather open crowns and are less common than the dwarf densely branched shrubby forms which are often much broader than high. Leafless except during and after the rains. Flowers in the hot weather.

4. *EUPHORBIA TIRUCALLI*, Linn. Sp. Pl. (1753) p. 452.—A shrub or small tree; branches round, unarmed, twigs quill-like, leafless or the leaves very small and caducous. Flower-heads numerous, in clusters at the ends and at the forks of the branches. *Milk-Hedge* or *Milk-Bush*.

Indigenous to East Africa from German East Africa to Natal. Has long been introduced in India and is grown in hedges in parts of the Kangra and Hoshiarpur Districts. Occasionally seen elsewhere. The wood is moderately hard, strong, not liable to the attacks of insects and according to Cooke is used for rafters. The latex yields rubber which is being extracted from it commercially in Natal, *vide* N. E. Brown in Kew Bull., 1914, p. 94. Flowers in the hot weather.

EUPHORBIA PULCHERRIMA, Willd.—A tall unarmed soft-wooded shrub. Leaves alternate, about 6-8 inches long, ovate-elliptic, acute, sinuate or shallowly lobed, soft, paler beneath; petiole 1-2.5 inches long, red. Upper leaves (or bracts) clustered, bright-red. Flowers inconspicuous. The *Poinsettia* of Indian gardens.

Indigenous to moist shady places in Mexico and Central America. Often grown in gardens for its brightly colored floral leaves. Propagated readily from cuttings. There is a variety with cream-colored floral leaves. Flowers in the cold season.

EUPHORBIA BOJERI, Hook.—A small shrub, very spiny; spines straight, 5-1 inch long, with broad dilated bases. Leaves alternate, 7-15 inches long, oblanceolate, mucronate, sessile. Peduncles axillary, about 1-15 inches long, dichotomously branched. Heads subtended each by 2 semi-orbicular bright-scarlet bracts (each looking like a 2-petalled flower about 4 inch across) within which is the cup-shaped involucre. Filaments simple (not forked) bearing 2 distinct globose anther-cells.

Indigenous to Madagascar. Often cultivated in gardens where it is usually called *E. splendens*, Boj., which is a very closely allied plant possibly not specifically distinct but in *E. splendens* the filaments are forked each branch bearing an anther-cell. Flowers: February—September.

2. BISCHOFFIA, Blume.

(In honor of G. W. Bischoff, a botanist and entomologist at the Royal Academy, Amsterdam. DISTRIB. Species only the following; India, Malaya and Polynesia.)

BISCHOFFIA JAVANICA, Blume, Bijdr. (1826) p. 1168.—A large evergreen tree, bark dark-brown nearly smooth. Leaves alternate, trifoliate; petiole 2-5-6 inches long, stipules 0. Leaflets 3-5 by 1-5-3 inches, elliptic or elliptic-oblong, acuminate, crenate, glabrous, rather soft; lateral nerves 6-8 pairs; petiolules of the lateral leaflets 2-4 inch long, of the terminal 1-15 inches long. Flowers minute, dioecious, in axillary or lateral paniculate racemes about as long as the petioles. Male flowers 1 inch diameter, rather crowded, pedicels 1 inch long; sepals 5, concave, covering the young stamens, imbricate; petals 0; disk 0; stamens 5; filaments short, anthers large, dehiscent lengthwise; pistillode short, broad. Female flowers 2 inch diameter, not crowded; pedicels rather longer than in the male, elongating in fruit; sepals flat, ovate, acute, not persistent in fruit; petals 0; disk 0; ovary exserted, glabrous, 3-4-celled; ovules 2 in each cell; styles long, linear, entire. Fruit 3 inch diameter, brown or black, globose, smooth; seeds 3-4, smooth, shining.

Sub-Himalayan tract from the Ravi eastwards. Not common only a few trees are met with here and there in shady moist ravines. Reaches a large size and grows fast. The wood is red, seasons well and is fairly durable. Although naturally found in moist or ever swampy places the tree grows well in gardens in the plains and is only occasionally slightly injured by extra sharp frosts. It is an ornamental tree but when grown in dry places is apt to become disfigured by the heavy crop of fruits. The tree is worthy of attention as a timber tree in plantations. Flowers: April, May.

3. BUXUS, Linn. (The Box, Boxwood or Boxtree.)

(The latin name of the Box, *Buxus sempervirens*, Linn., used by Virgil and Pliny.)

Evergreen shrubs or trees. Leaves opposite, coriaceous, entire, penninerved. Flowers greenish-yellow, monœcious, in very short erect dense axillary racemes. Male flowers ebracteate; sepals 4, in two series, imbricate; stamens as many as sepals and opposite them; free; anthers ultimately recurved; ovary rudimentary. Female flowers; sepals 6, the 2 outer

much smaller, imbricate; ovary 3-celled; ovules 2 in each cell, pendulous; styles 3, short, thick. Capsule ovoid, tipped by the persistent styles, loculicidally 3-valved, valves 2-horned by the split styles, endocarp splitting away from the coriaceous exocarp. Seeds oblong, black, shining. **DISTRIB.** Species 20; temperate and tropical.

Leaves shining above, pale-green beneath; horns of the capsule spreading ... 1. *B. Wallichiana*.

Leaves dull-green above, pale and whitish (papillose) beneath; horns of the capsule erect ... 2. *B. papillosa*.

1. *BUXUS WALLICHIANA*, Baillon, *Monogr. Bux. et Styloc.* (1859) p. 63.—A small tree, shoots pubescent. Leaves 1-2 by .3-.5 inch or occasionally 3 by .8 inch, lanceolate or narrowly elliptic-oblong, obtuse, bright glossy green above paler beneath, nerves when dry fine but distinct; petiole .05-.1 inch long, pubescent. Racemes very short and congested, about .3 inch long, subglobose, terminal flower female. Sepals .1-.15 inch long, thin, obtuse. Stamens exserted; anthers oblong, attached near the base. Styles equalling the ovary. Capsule .4-.5 inch long including the horns, .3-.4 inch wide, broadly ovoid, chestnut-brown when ripe, horns diverging. Seeds .25 inch long. *B. sempervirens*, Linn. in *Fl. Brit. Ind.*, *ex parte*. *Box*, Vern. *Shamshād*, *Sansād* (Bash.).

Himalaya 4-9,000 feet. Found locally, gregarious in patches usually in moist shady places. Kangra, Kulu, Simla and Bashahr. Kashmir to Kumaon. The bark is grey, soft and corky, cut into small plates by vertical and horizontal fissures. The wood is yellowish, hard, smooth, very close and even-grained. It is used for engraving, turning, carved boxes and mathematical instruments. The demand for boxwood is good and it is sold by weight not by volume. The value depends far more than with other woods on the freedom from knots and cracks. Small wood even 2-4 inches in diameter is quite saleable if of good quality and long lengths are not required. The wood is very apt to split and to check this tendency the billets may be sawn down one side from the circumference to the centre so that shrinkage may widen this split and prevent others appearing. A good deal has been written about the utilization of boxwood in the Punjab and attempts were made to extract it from Bashahr where the supply is largest but they resulted in a considerable loss. Owing to its inaccessibility boxwood is not likely to be of any value nor is the supply large, in Bashahr the area bearing boxwood is estimated at 820 acres and it does not occur pure over one-tenth of this area. The rate of growth averages 18 rings per inch of radius. Reaches 30 feet in height and 4 feet in girth with a clean stem of 10-15 feet in Bashahr. **Flowers:** March–May.

2. *BUXUS PAPILLOSA*, C. K. Schn. *Illustr. Handb. Laubholz.* II (1907) p. 139.—A large shrub or small crooked tree, shoots hoary. Leaves usually 1.5-3 by .2-.4 inch, linear-oblong, sometimes 1-2 by .4-.5 inch, oblanceolate or narrowly elliptic, subacute, dull-green above pale whitish and papillose beneath, nerves when dry usually quite obscure; petiole minute to .1 inch long, glabrous. Flowers as in the above. Capsule

·4·5 inch long, including the horns, ·25·8 inch wide, ovoid, pale-brown when ripe, horns erect. *B. sempervirens*, Linn. in Fl. Brit. Ind., *ex parte*. Box. Vern. *Shamshād*.

Outer Himalaya 2-4,000 feet from the Jhelum westwards. Salt Range. Trans-Indus. Usually on dry arid limestone hills. Margalla and Kala-Chitta Reserves, Rawalpindi; Garamthun Reserve, Hazara. Gregarious in patches. This species is more abundant than *B. Wallichiana* but is not nearly so straight and erect in habit otherwise the timber is similar. It is used only for firewood. Cultivated in Lahore and forms a small tree with straight stem and comparatively little foliage. It is propagated by cuttings. The rate of growth in Rawalpindi Division is 30-40 rings per inch of radius. Flowers sweet-scented, December—February.

4. TREWIA, Linn.

(In honor of C. J. Trew, a botanist of Nuremberg, 1695-1769. *DISTRIE*. Species 2; India, Ceylon and Malaya.)

TREWIA NUDIFLORA, Linn. *Sp. Pl.* (1753) p. 1193.—A large deciduous tree, bark smooth, pale-grey, young shoots, leaves and inflorescence clothed with caducous grey tomentum. Leaves opposite, 6-9 by 4·5-7 inches, ovate, entire, acuminate, base usually cordate, 3- or 5-nerved, glabrous when mature, glandular at the base near the top of the petiole; petiole 2-4 inches long; stipules minute, acute, caducous. Flowers dioecious, petals 0, disk 0. Male flowers yellow, ·3 inch across, arranged in bracteate 1-4-flowered fascicles on the rachis of a lax drooping raceme 4-9 inches long; racemes appearing before the leaves from naked buds or in the axils of the young leaves; pedicels ·1·2 inch long, slender, jointed; sepals 3-5, concave, valvate, ultimately reflexed, ·15·2 inch long, pubescent; stamens numerous, free, on a convex torus, anthers erect, dehiscing longitudinally; pistillode 0. Female flowers green, solitary or 2-3 together, common axillary peduncles about 1 inch long; calyx ·3·4 inch long, flask-shaped, shortly 3-5-toothed, densely grey-villous, closely surrounding the ovary, ultimately splitting down one side and dropping off; ovary 2-5-celled, villous, hidden by the calyx; ovules 1 in each cell; styles as many as ovary-cells, shortly connate below, ·5·7 inch long, entire, conspicuously papillose. Fruit drupaceous, 1-1·5 inches diameter, depressed-globose, green, pericarp rather firm somewhat succulent, stone 2-5-celled. Brandis, *Ind. Trees*, fig. 184 (female flower wrongly drawn). Vern. *Kumhār*, *gumhār*.

Sub-Himalayan tract near the Jumna, Kalesar. A tree of moist or swampy places especially along streams. Common between the Ganges and Jumna but only just extends into the Punjab. The wood is white, soft and not durable, it is good for packing cases and purposes for which a soft wood is required but gets discolored unless cut up green and quickly dried. The tree much resembles *Gmelina arborea* and has the same vernacular names but the leaves are not so pale beneath. Cultivated in Lahore. The male tree is handsome but female trees grown in the open appear to produce short stems and wide-spreading heavy branches. The leaves in seedlings are alternate and toothed. Flowers: February—April.

5. *BRIDELIA*, Willd.

(In honor of S. E. Bridel-Brideri, a Swiss botanist of the 18th century.)

Trees, shrubs or climbers. Leaves alternate, usually entire, secondary nerves prominent. Flowers monœcious or dioecious, small, sessile or nearly so, in axillary or spicate clusters; bracts small, numerous. Male flowers; calyx-segments 5, valvate, persistent; petals 5, small; disk broad, lining the calyx-tube, extra-staminal; stamens 5, filaments united below into a short column which bears the pistillodes, free and spreading above; anthers 2-celled, cells parallel. Female flowers; calyx-segments usually narrower than in the male, often deciduous; petals as in the male; disk double, the outer as in the male, the inner often enclosing the young ovary; ovary 2- rarely 3-celled; ovules 2 in each cell; styles free or shortly connate, each bifid. Fruit a small drupe containing 1-2 one-seeded pyrenes. **DISTRIB.** Species about 30; tropics of the Old World.

Nerves 15-20 pairs; flowers in axillary and
spicate clusters; fruit globose ... 1. *B. retusa*.

Nerves 8-16 pairs; flower-clusters all axillary;
fruit ellipsoid ... 2. *B. montana*.

1. *BRIDELIA RETUSA*, Spreng. *Syst. Veg.* III (1826) p. 48.—A medium-sized or small deciduous tree, when young with long conical thorns on the trunk; bark dark-grey; twigs pubescent or glabrous. Leaves 4-10 by 2-4·5 inches, elliptic-oblong or somewhat obovate, acute, entire or slightly crenulate, base rounded, usually glabrous above, pale glaucous and slightly pubescent beneath; lateral nerves 15-20 pairs, prominent, straight; petiole 2-·5 inch long, swollen; stipules deltoid, acuminate, caducous. Flowers dioecious and monœcious, greenish-yellow, in small clusters which are solitary and axillary or arranged in axillary or terminal often paniculate spikes. Calyx 2 inch across, segments deltoid-ovate in the male, narrower in female flowers, acute, spreading. Petals shorter than the sepals, cuneate-obovate and coarsely toothed in the male, sub-rhomboid in female flowers. Disk very fleshy and conspicuous in the male, short truncate enclosing the base of the ovary in female flowers. Fruit 3 inch diameter, globose, seated on the enlarged calyx, greenish-yellow or nearly white when ripe. Vern. *Ghāja* (Simla).

Sub-Himalayan tract from the Ravi eastwards. Not common. Wood hard or moderately so, grey to olive-brown, close-grained, seasons well and is durable. The growth is fairly fast. It is a handsome tree when well grown but is rarely cultivated. The fruit is edible. Flowers: May—October.

2. *BRIDELIA MONTANA*, Willd. *Sp. Pl.* IV (1805) p. 978.—A large shrub or small straggling tree without thorns; twigs

glabrous, verrucose. Leaves 3-6 by 1.5-3.5 inches, usually elliptic-obovate, sometimes elliptic or oblong, usually rounded, sometimes acute at the apex, base rounded or somewhat narrowed, entire or undulate, bright-green above, more or less pale and glaucous beneath, glabrous or nearly so; lateral nerves 8-16 pairs, more or less arched; petiole 1-3 inch long, swollen; stipules caducous. Flowers monœcious and dicecious, greenish-yellow, in small axillary clusters. Calyx 1 inch long, segments erect, narrowly triangular in the male, deltoid in female flowers. Petals shorter than the sepals, obovate, keeled on the back, coarsely toothed in the male, entire in female flowers. Disk rather small in the male, nearly enclosing the ovary in female flowers. Fruit .25 inch long, ovoid, seated on the unenlarged calyx (black when ripe?).

Sub-Himalayan tract from the Indus eastwards. Rare west of the Jhelum but found occasionally in rocky ravines. Too small and crooked to be of any economic value in the Punjab. Flowers: November—February.

6. DAPHNIPHYLLUM, Blume.

(From the Greek *Daphne*, the Bay Tree, and *phullon*, a leaf; referring to the lauraceous appearance of the foliage. **DISTRIB.** Species about 12; Africa, India, Malaya to Japan.)

DAPHNIPHYLLUM HIMALAYENSE, Muell. Arg. in DC. Prodr. XVI, 2 (1869) p. 4.—A small evergreen tree, bark smooth, brown. Leaves alternate, 5-10 by 1.7-3 inches, oblong, finely acuminate, entire, base narrowed, glabrous and shining above, glaucous beneath; lateral nerves 10-14 pairs, slender; petiole 1-2 inches long; stipules 0. Flowers dicecious, apetalous, in racemes 3-4 inches long, axillary or from below the leaves. Male flowers; calyx-lobes 3-8, small; stamens 5, filaments short; anthers large, apiculate, erect; pistillode 0. Female flowers; calyx as in the male, deciduous; ovary 2-celled; ovules 2 in each cell; styles free, recurved, undivided. Drupe .5-.7 inch long, ellipsoid, usually 1-seeded, oblique.

Outer Himalaya 4-8,000 feet. From the Kangra District eastwards. Rare. A tree of moist-shady ravines. Wood grey with streaks of bright red. Flowers: April—May.

7. ANTIDESMA, Linn.

(From the Greek *anti*, against, and *demos*, a band; referring to the annular disk under the ovary. **DISTRIB.** Species 60-70; Tropical Asia, Africa, Australia and the Pacific Islands.)

ANTIDESMA DIANDRUM, Roth, Nov. Pl. Sp. (1821) p. 369.—A large deciduous shrub or small tree, shoots rusty-tomentose. Leaves alternate, 2-6 by 1-2 inches, variable, the larger usually oblong-oblongate, the smaller obovate or elliptic, usually acuminate, entire, base acute, glabrous above, glabrous or slightly pubescent beneath, rather thick and soft but scarcely

fleshy, nerves faint; petiole .1-.2 inch long; stipules .25 inch long, linear-lanceolate, acute. Flowers minute, dicecious, in slender terminal racemes 1-2.5 inches long, racemes simple or with a few branches; pedicels .05 inch long; bracts at the base of each pedicel, ovate, about half as long as the pedicel. Male flowers; pedicels slender; calyx cupular, minute, obscurely 4-lobed; stamens usually 2, inserted at the base of a small glabrous lobed disk; anthers didymous, the cells globose, much exserted. Female flowers; pedicels stout; calyx as in the male; disk annular; ovary 1-celled; ovules 2, pendulous; stigmas 2, two-fid. Drupe .2 inch diameter, subglobose, purplish-red when ripe, edible. Vern. *ambhu* (Ka.).

Sub-Himalayan tract from the Ravi eastwards. Also in Kashmir. Frequent in Kangra, in shady places. The leaves turn bright red in the cold weather and remain so till shed in March. The leaves are acid and are eaten, and according to Haines when young make an excellent spinach. Flowers: June—July.

8. PHYLLANTHUS, Linn.

(From the Greek *phyllon*, a leaf, and *anthos*, a flower; in species of the section *Xylophylla* the branches have the appearance of pinnate leaves and the flowers appear to be borne on the edges of the leaflets.)

Herbs, shrubs or trees, usually deciduous. Leaves alternate, often distichous and close-set giving the branchlets the appearance of pinnate leaves and deciduous as a whole; stipules usually narrow or 0. Flowers small or minute, unisexual, usually monœcious, apetalous. Sepals 4-6, free or shortly connate, imbricate, more or less 2-seriate. Male flowers; disk various, rarely wanting; stamens central, 2-5, filaments free or connate; pistillode 0. Female flowers; disk various; ovary 3-15-celled; ovules 2 in each cell; styles free or connate, usually 2-fid. Fruit usually capsular, separating into crustaceous or coriaceous 2-valved cocci, with or without a coriaceous or fleshy separable epicarp, sometimes a berry or a drupe with a 3-4-celled stone. DISTRIB. Species about 400; all warm countries.

A tree; leaves linear-oblong; fruit a succulent drupe 1. *P. Emblica*.

A small shrub; leaves ovate; fruit a capsule ... 2. *P. parvifolius*.

1. PHYLLANTHUS EMBLICA, Linn. *Sp. Pl.* (1753) p. 982.—A small or medium-sized deciduous tree; bark grey, smooth; twigs glabrous or pubescent, 4-8 inches long, often deciduous with the close-set leaves which thus appear to be pinnate. Leaves distichous, 4.5 by .1 inch, linear-oblong, entire, obtuse, glabrous, light-green above, paler beneath, subsessile; stipules ovate, acute or acuminate, minute, deciduous. Flowers minute, greenish, in axillary fascicles on the leafy twigs, often on

the naked portion below the leaves ; pedicels .05 inch long, very slender with minute fimbriate bracts at the base in the male, female flowers subsessile. Sepals 6, .05 inch long, oblong, obtuse. Male flowers ; disk 0 or of 6 minute glands ; anthers 3, erect on a short column composed of the united filaments, dehiscing by vertical slits. Female flowers ; disk cupular, toothed ; ovary 3-celled ; styles connate at the base, irregularly twice bi-fid, segments acute. Fruit .7 inch diameter, subglobose, yellow, succulent, containing a 6-ridged stone which ultimately separates into 3 two-valved cocci. Vern. *Aonla*, *Amli* (Rp.).

Sub-Himalayan tract from the Indus eastwards ascending to 4,500 feet in the outer Himalaya. Found locally in Hazara and Rawalpindi, not commonly met with except to the east of the Ravi. Frequently cultivated in the plains. The wood is red, hard, with no heartwood, it warps and splits but is a good firewood and the tree coppices well. The fruit is eaten, usually pickled. Flowers : March—May.

2. *PHYLLANTHUS PARVIFOLIUS*, *Buch.-Ham. in D. Don, Prodr. Fl. Nep.* (1825) p. 63.—A small shrub 1-4 feet high, ultimate twigs capillary. Leaves .25-.5 by .15-.3 inch, obovate or elliptic-oblong, entire, mucronate, glabrous, pale beneath ; petiole minute ; stipules .05 inch long, exceeding the petiole, linear, acuminate. Flowers .1 inch across, the female slightly larger, brown-purple, solitary or few together in the leaf-axils ; pedicels .15 inch long in male, .1 inch long in female flowers. Male flowers ; sepals 5-6, obovate-oblong, .05 inch long, obtuse, margins thin ; disk of minute glands ; stamens 3, filaments free, anthers minute, didymous. Female flowers ; sepals elliptic, rather larger than in the male ; disk annular, surrounding the base of the ovary, undulate ; ovary 3-celled, globose ; styles 3, shortly 2-fid. Capsule .2 inch diameter, depressed-globose, dull black with a (dry ?) separable epicarp, separating into 3 crustaceous 2-valved cocci ; seeds dull-brown, wedge-shaped, with 2 flat and 1 curved surfaces.

Himalaya 4-8,000 feet. On rocks. Kashmir to Kumaon. Apparently not common in the Punjab but occurs near Theog along the Hindustan-Tibet road. Flowers : September - October.

9. *PUTRANJIVA*, Wall.

(From the Hindi name *putra-jiva*, meaning life of the child ; the stones of the fruit are made into necklaces for children to keep them in health. *DISTRIB.* Species 2 ; Indian.)

PUTRANJIVA ROXBURGHII, *Wall. Tent. Fl. Nep.* (1826) p. 61.—A small or moderate-sized evergreen tree with pendent branches, bark yellowish-grey, nearly smooth. Leaves alternate, 2-4 by 1-1.5 inches, elliptic, oblong, acute, obtuse or shortly acuminate, margin wavy and obscurely serrulate,

glabrous, dark-green, glossy above, base oblique, lateral nerves numerous, fine; petiole $\cdot 2\text{--}3$ inch long, pubescent; stipules small, acute, caducous. Flowers dioecious, small, axillary. Male flowers yellow, in heads or contracted racemes, pedicels very short; calyx $\cdot 07$ inch long, 3-5-partite, lobes imbricate; petals 0; disk 0; stamens 1-5 usually 3, central, filaments more or less connate at the base, anthers large, erect, globose, dehiscing by broad longitudinal slits; pistillode 0. Female flowers green, solitary or 2-3 together; pedicels $\cdot 3\text{--}5$ inch long; calyx as in the male; petals 0; disk 0; ovary tomentose, 3-celled; ovules 2 in each cell; styles short, spreading, dilated, with broad fleshy arms. Drupe $\cdot 6$ inch long, ellipsoid, pointed at both ends, grey-tomentose, pedicels $\cdot 5\text{--}7$ inch long; stone pointed, rugose, very hard, 1-seeded. Vern. *Putājan, jiā puta*.

Sub-Himalayan tract from the Ravi eastwards. Common in Kangra. Much lopped for fodder. Wood light-grey, fairly hard, even-grained, fairly durable. It is suitable for turning. The tree is very handsome when well grown and is often cultivated in the Sub-Himalayan tract as well as in the plains. The growth is rather slow especially when young. Flowers: March—May.

10. SARCOCocca, Lindl.

(From the Greek *sarx*, *sarkos*, flesh, and *kokkos*, a berry; referring to the fleshy fruit. **DISTRIB.** Species 3; Asiatic.)

SARCOCocCA SALIGNA, Muell. Arg. in DC. Prodr. XVI i (1869) p. 11.—A glabrous evergreen shrub 2-4 feet high. Leaves alternate, $2\cdot 5\text{--}4$ by $\cdot 3\text{--}1$ inch, lanceolate or linear-lanceolate, long-acuminate, entire, base narrowed, shining above; petiole $\cdot 2\text{--}3$ inch long. Flowers $\cdot 3$ inch long, yellowish, unisexual, in short axillary racemes of about 4 flowers either all of one sex or male above and female below. Male flowers 2-bracteate; sepals 4; stamens 4, free, opposite the sepals, exserted, anthers oblong, ultimately recurved; ovary rudimentary. Female flowers with 2 bracts and about 4-6 overlapping scale-like sepals; ovary 2-3-celled; ovules 2 in each cell, pendulous; styles 2-3, recurved, flattened. Fruit drupaceous, $\cdot 3$ inch long, ovoid, dark-purple, containing 1-2 seeds. *S. pruniformis*, Lindl. Fl. Brit. Ind. V, p. 226. Collett, Fl. Siml., fig. 146.

Himalaya 5-9,000 feet from the Indus eastwards. Common and sometimes gregarious in moist or shady places. Occasionally found as low as 3,000 feet in moist cool places. Also Trans-Indus. Flowers: September—November and March—May (possibly September—May.)

11. FLUEGGEA, Willd.

(In honor of J. Fluegge, a German botanist and author of a monograph of the grasses in 1810.)

Shrubs, armed or not. Leaves alternate, entire. Flowers dioecious, minute, apetalous, on slender pedicels. Male flowers in dense clusters; sepals 5, subpetaloid, imbricate; stamens 5, rarely fewer, longer than the sepals, alternating with disk-glands, filaments free, anthers erect, dehiscing lengthwise; pistillode 3-fid. Female flowers in lax fascicles; sepals as in the male; disk annular, lobed; ovary 3-celled; ovules 2 in each cell; styles free, recurved, usually 2-fid. Fruit globose, coriaceous or with a fleshy epicarp, bursting irregularly into 2-valved cocci. Seeds wedge-shaped with 2 flat and 1 curved surface. **DISTRIB.** Species 6; tropics of the Old World.

Unarmed; leaves 1-3 inches long ... 1. *F. microcarpa*.

Thorny; leaves rarely over 1 inch long ... 2. *F. Leucopyrus*.

1. *FLUEGGEA MICROCARPA*, Blume, *Bijdr.* (1825) p. 580.—A shrub or small tree, evergreen; bark grey, smooth; twigs often reddish-brown, angular. Leaves 1-3 (-4) inches long, suborbicular, obovate or elliptic, obtuse or subacute, base usually narrowed, glabrous, somewhat glaucous and reticulate beneath; petiole .1-.5 inch long. Flowers greenish, less than .1 inch across. Male flowers; pedicels up to .4 inch long, capillary; sepals .05 inch long, broadly elliptic; stamens 3-5; pistillode large, 3-fid. Female flowers; pedicels rather shorter; sepals as in the male; ovary glabrous, ovoid; styles 3, deeply 2-fid, branches spreading, recurved. Fruit of two kinds; mostly dry, .15 inch diameter, obscurely 6-lobed; a few .3 inch diameter, white, succulent, edible.

Himalaya ascending to 5,000 feet, from the Indus eastwards. Not very common. Also Trans-Indus, Salt Range, Pabbi Hills. Usually a small shrub with long straight erect shoots which make good walking sticks, tent pegs, etc. Flowers: May—June.

2. *FLUEGGEA LEUCOPYRUS*, Willd. *Sp. Pl.* IV (1805) p. 757.—A rigid bushy shrub; branches pale-grey ending in sharp thorns. Leaves rarely over 1 inch long. Otherwise as for *F. microcarpa*, Bl.

Punjab plains; Hissar. This would appear to be a form of *F. microcarpa* rendered more rigid and thorny by a dryer climate except that there are no intermediate specimens. Haines For. Fl. Chota Nagpur, p. 222, says for *F. microcarpa* "rarely thorny" but I have not observed this. Brandis gives the Salt Range in his list of localities for *F. Leucopyrus* but all the specimens I have seen from that area are unarmed. Flowers: August (in Hissar).

12. *GLOCHIDION*, Forst.

(From the Greek *glochis*, an angular point; referring to the produced connectives in some species. **DISTRIB.** Species about 120; chiefly in Tropical Asia.)

GLOCHIDION VELUTINUM, Wight, *Icon.* V ii (1852) p. 29, t. 1907-2.—A small evergreen tree, nearly all parts pubescent or tomentose; bark brown, rough, Leaves alternate, 2-4 inches long,

broadly elliptic or oblong, acute or abruptly shortly acuminate, entire, pubescent on the nerves above when mature, persistently pubescent or tomentose beneath; lateral nerves 4-6 pairs; petiole .1 inch long; stipules short, subulate. Flowers .2 inch across, monœcious, both sexes together in axillary fascicles. Petals 0. Disk 0. Male flowers yellow; pedicels .5 inch long, slender; sepals 6, elliptic-oblong, .12 inch long, rather thick, subacute, 2-seriate; stamens 3, anthers sessile, connate in an ellipsoid column, dehiscing longitudinally, tipped by the minutely produced connective; pistillode 0. Female flowers green; pedicels .1 inch long, stout; sepals as in the male but more tomentose; ovary 4-7-celled, pubescent; ovules 2 in each cell; styles connate in a subglobose or subterete pubescent column longer than the ovary and 4-7-toothed at the apex. Capsule .4 inch across, orbicular, depressed, usually 4-celled and 8-lobed, pubescent, breaking up into 2-valved cocci and leaving a central axis around which the bright red seeds frequently remain.

Sub-Himalayan tract and low valleys ascending to 5,000 feet from the Indus eastwards. Common in the zone of *Pinus longifolia*. The wood is not used, it is brownish-white compact but soft. The bark is used for tanning and the leaves are said to be not eaten by goats. Flowers: May-June.

13. ANDRACHNE, Linn.

(A classical plant name used by Pliny for the *Purslain*, *Portulacca oleracea*, Linn.; some species of the genus are not unlike the *Purslain*.
DISTRIB. Species about 10; widely distributed.)

ANDRACHNE CORDIFOLIA, Muell. Arg. in DC. Prodr. XV ii (1866) p. 234.—A deciduous shrub 2-3 feet high; twigs slender, green, slightly pubescent. Leaves alternate, 1-4 by .5-1.8 inches, elliptic or ovate, the larger oblong, all entire, rounded at both ends, mucronate, thinly membranous, glabrous above, pale and thinly pubescent beneath; petiole .3-1.3 inches long, very slender. Flowers less than .2 inch across, green, monœcious, solitary or several together in the leaf-axils; pedicels .5-1.5 inches long, capillary. Male flowers; calyx hairy outside, 5-partite, segments oblong or obovate; petals 5, shorter than the calyx-segments, obovate-oblong; disk conspicuous, extra-staminal, 10-lobed; stamens 5, free, anthers erect, the cells parallel; pistillode minute. Female flowers; calyx as in the male but accrescent and .4 inch across in fruit; petals reduced to small glands; disk a crenulate ring surrounding the base of the globose ovary; ovary 3-celled; ovules 2 in each cell; styles 3, 2-fid almost to the base. Capsule .3 inch across, depressed-globose, slightly 3-lobed, breaking up into 3 two-valved cocci; seeds dull pale-brown, wedge-shaped with 2 flattened and 1 curved surfaces. Collett, Fl. Siml., fig. 147. Vern. *Kurkan* (Haz.)

Himalaya. Common in shady places especially at 5-8,000 feet, from the Indus eastwards. Flowers: May—September.

14. MALLOTUS, Lour.

(From the Greek *mallos*, wool; referring to the tomentose leaves and branches of many species. **DISTRIB.** Species 70-80; tropics of the Old World chiefly Indo-Malayan.)

MALLOTUS PHILIPPINENSIS, Muell. Arg. in *Linnæa*, XXXIV (1865) p. 196.—A small evergreen tree, old stems much fluted, bark dark-grey, thin, somewhat rough, young shoots and inflorescence rusty-pubescent. Leaves alternate, very variable, usually 3-6 by 2-3 inches (sometimes 9 by 5 inches), ovate, ovate-oblong, elliptic or sometimes lanceolate, acuminate, entire or serrulate, glabrous above, minutely pubescent beneath and closely dotted with minute red glands, distinctly reticulate, base usually rounded, 3-nerved; petiole 1-3 inches long, pubescent, with 2 small sessile glands one on either side at the top. Flowers .15 inch across, yellowish, dioecious, petals 0; disk 0. Male flowers in terminal clustered erect spike-like racemes 4-10 inches long, a few solitary racemes occasionally in the axils of the upper leaves; pedicels .05 inch long, clustered; bracts minute; calyx .1 inch long, cleft almost to the base, lobes 4, valvate, tomentose outside, reflexed; stamens numerous, free, crowded on a convex torus, anthers erect, cells shortly oblong, dehiscing longitudinally; pistillode 0. Female flowers spicate, spikes solitary or several, terminal or a few axillary, 1-4 inches long; pedicels 0 or very short, solitary, occasionally distinct in fruit; bracts minute, acute, thick; calyx .1 inch long, 3-4-fid, persistent below the fruit but not accrescent; ovary 3-celled, densely stellately tomentose; ovules 1 in each cell; styles 3, spreading, entire, plumose. Fruit a capsule, .3-.5 inch diameter, 3-lobed, covered when ripe with a red resinous powder. Seeds subglobose, black. Vern. *Kamila*, *raiuni* (Bash.).

Sub-Himalayan tract and outer Himalaya ascending to 4,000 feet from the Indus eastwards. One of the commonest plants in the zone which it occupies both in the forest and in the grazing grounds, waste places and hedges. It is at once recognized by the minute red glands with which the lower surface of the leaves is closely dotted; they are easily seen with a small lense. The leaves are little touched by cattle and goats which in a large measure accounts for its prevalence. The wood is white with a light or dark red small heartwood, it is used only for firewood. The powder on the capsules can be used as a dye for silk, it is also used medicinally as a remedy for tape-worm. Coppices well. Flowers: September—November.

15. SAPIUM, P. Br.

(From *Sappium* or *Sapinus* of Pliny, a name used for some pine or fir tree; the allusion is to the exudation from wounds in the bark in the pine and in trees of this genus.)

Trees or shrubs. Leaves alternate; petiole often 2-glandular at the apex. Flowers unisexual, dioecious or monoecious, in terminal spikes, the male clustered in the axil of a

bract, the female solitary in the axil of each bract, at the base of the male spikes or in separate spikes. Male flowers; calyx unequally 2-3-lobed or splitting with 2-3 valvate segments; petals 0; disk 0; stamens 2-3, filaments free, anther-cells ovoid, distinct; pistillode 0. Female flowers; calyx 3-fid or -partite; petals 0; disk 0; ovary 2-3-celled; ovules 1 in each cell; styles free or connate, spreading or recurved, entire. Fruit a capsule, crustaceous, fleshy or pulpy, rarely woody, ultimately loculicidally 3-valved. Seeds globose or ovoid, estrophiolate, usually long persistent on a columella. **DISTRIB.** Species 25; tropics of both hemispheres.

Leaves entire, rhomboid; spikes androgynous,
appearing after the leaves ... 1. *S. sebiferum*.

Leaves oblong-lanceolate or elliptic; spikes
unisexual, appearing before the leaves ... 2. *S. insignis*.

1. **SAPIUM SEBIFERUM**, Roxb. *Fl. Ind.*, III (1832) p. 693.—A small or medium-sized deciduous tree, stem often crooked and gnarled, bark rough not deeply fissured. Leaves 1·5-3 inches long and broad, rhomboid, acuminate, entire, glabrous, pale or somewhat glaucous beneath; petiole 1-2 inches long, slender, with two small glands at the tip; stipules ·1 inch long, linear, caducous. Flowers yellow, monœcious, in drooping spike-like racemes 2-8 inches long, usually solitary at the ends of the leafy shoots, male flowers above, female below. Male flowers numerous; pedicels ·1 inch long or very short; bracts broadly ovate, acuminate, with a large gland on either side at the base; calyx cup-shaped, ·05 inch across, margin irregularly toothed; stamens 2, filaments minute, anthers large, half-exserted. Female flowers few, sometimes in the lower clusters mixed with the male flowers; pedicels ·1 inch long, stout; calyx ·1 inch long, sepals ovate, acute; ovary glabrous, narrowed into a stout style with long recurved stigmas. Capsule ·4-·6 inch diameter, subglobose, 3-valved, valves coriaceous, breaking away and leaving the seeds attached to the apex of a central column which splits into 3 slender divisions. Seeds enclosed in a thick layer of white fatty substance. *Tallow Tree*. Vern. *Makkhan* (Ka.), *charbi*.

Indigenous to China and Japan. Completely naturalized in the Kangra District and locally naturalized in many other places, e.g., on banks and islands in the river Jhelum at Jhelum. Cultivated in gardens in the plains and in the outer Himalaya up to 6,000 feet. The Tallow Tree likes a moist situation such as the banks of streams and when introduced in such places soon spreads both by seed and by root-suckers which are freely produced. In Kangra it is often seen springing up on roadsides and on the edges of rice fields where it thrives and is untouched by all browsing animals. On good moist soil it reaches a fair size, 50 feet in height by 6-8 feet in girth, but on poor soil it remains small. Near Palampur, Kangra, it is found growing along small dry ravines in a forest of *Pinus longifolia*, but remains a shrub in such places. It has been tried in Changa Manga, but without success, the long periods of

drought evidently not suiting it as a few trees may be seen growing well enough along the irrigation channels which are constantly used. The growth is fast and coppice reproduction as well as reproduction by root-suckers excellent. The wood is white, moderately hard, it is not used for timber, but is a fair fire-wood. The leaves much resemble Sissoo leaflets and at a little distance the tree is not unlike the Sissoo and occasionally the same vernacular names are used. The fatty substance (vegetable tallow) around the seeds is used in China for making candles, but it has never been collected economically in India. The leaves in autumn turn magnificent tints varying from pale lemon to crimson and it is for this reason that the tree is popular in gardens. Flowers: June—August.

2. *SAPIUM INSIGNE*, *Trim. Syst. Cat. Ceyl. Pl.* (1885) p. 83.—A small or large deciduous tree, bark smooth grey and shining when young, very rough and corky when old, branches stout, juice thick milky. Leaves 6-12 by 2-4 inches, elliptic-oblong or lanceolate-oblong, acuminate, crenate-serrate, soft, glabrous, base acute or narrowed, lateral nerves 10-16 pairs; petiole 1-2 inches long, with 2 conspicuous glands at the apex. Flowers dioecious, in erect thick spikes 3-8 inches long. Male flowers in dense circular clusters .2-.3 inch diameter, the central flowers opening first and shortly pedicellate, the outer sessile; bracts small, fleshy; sepals 2, orbicular, .05 inch long, concave; stamens 2, filaments short, anthers exerted. Female flowers shortly pedicelled; sepals ovate, acuminate; ovary ovoid, glabrous; styles 3, short, spreading, slightly connate at the base. Capsules .3 inch long, ovoid, fleshy at first, dry and irregularly dehiscent when ripe, closely packed along the fleshy axis. Brandis, *Ind. Trees*, fig. 183.

Sub-Himalayan tract and outer Himalaya from the Ravi eastwards ascending to 5,000 feet. Common. Often seen in the undergrowth of *Pinus longifolia* forests on the lower slopes of the Himalaya, in such places quite small and constantly cut back by frost. It is grown by villagers of the Kangra District in hedges. Cuttings formed from the ends of the shoots root readily. On good soil it forms a large handsome tree. The wood is white, soft and spongy, it is not used. Male trees are much commoner than female. Flowers when leafless in January—March.

16. *BALIOSPERMUM*, Blume.

(From the Greek *balios*, spotted, and *sperma*, a seed. *DISTRIB.* Species 6; Indo-Malayan.)

BALIOSPERMUM AXILLARE, *Blume, Bijdr.* (1825) p. 604.—A stout erect undershrub 2-4 feet high. Leaves alternate, very variable in size and shape, (2-) 4-6 (-10) inches long, elliptic or ovate, undivided or deeply 3-lobed, acute or acuminate, irregularly and coarsely but not sharply toothed or serrate, base rounded or subcordate, 3-nerved or sometimes 5-nerved, pubescent when young usually glabrous when mature; petiole .5-3 inches long, often with 2 obscure glands at the top; stipules reduced to small glandular tubercles. Flowers minute, greenish, monœcious, in lax interrupted axillary racemes, usually very short but sometimes 2 inches long, flowers all male or the lower

female; pedicels .15-.2 inch long, clustered, many together, with minute bracts at the base. Male flowers about .1 inch across, globose; sepals 4-5, membranous, orbicular, concave, imbricate; petals 0; disk of lobulate glands connate into a low ring; stamens 15-20, free, anther-cells adnate for their whole length to the edge of a flattened orbicular connective, confluent; pistillode 0. Female flowers subsessile; sepals 5, ovate, acute, crenate; petals 0; disk short, cupular, crenate; ovary usually 3-celled, 3-lobed, densely hairy; ovules 1 in each cell; styles stout, 2-fid, not fimbriate or papillose. Capsule .3-.4 inch long, 3-lobed, slightly pubescent or glabrous, breaking up into 3 two-valved cocci, supported by the persistent but not enlarged calyx, pedicel .2 inch long, deflexed. *B. montanum*, Muell. Arg.

Sub-Himalayan tract from Kashmir eastwards. Salt Range. Not common. A plant of fire-lines, road-sides, &c. In flower or fruit all the year round.

17. JATROPHA, Linn.

(From the Greek *iätros*, a physician, and *trophé*, food; referring to the medicinal properties. DISTRIB. Species 70; chiefly Tropical American.)

JATROPHA CURCAS, Linn. *Sp. Pl.* (1753) p. 1006.—A large deciduous soft-wooded shrub or small tree, juice sticky-opalescent. Leaves alternate, 4-6 by 3-5 inches, broadly ovate, cordate, acute, usually palmately 3- or 5-lobed, glabrous, base 7-nerved; petiole 3-9 inches long; stipules 0. Flowers .8 inch across, yellowish-green in loose axillary cymose panicles 2-5 inches long; peduncles and pedicels more or less tomentose; bracts up to .4 inch long, linear. Male flowers; calyx .15 inch long, deeply 5-cleft, lobes elliptic, obtuse, imbricate; corolla one and a half times as long as the calyx, campanulate, villous within, lobes 5; disk of 5 large glands; stamens 10, biseriate, filaments of the inner series connate half-way up in a central column, anthers oblong, apiculate, erect; pistillode 0. Female flowers; calyx .2 inch long, lobes ovate, acute; corolla scarcely exceeding the calyx; disk as in the male; ovary 3-celled; ovules solitary in each cell, pendulous; styles connate at the base; stigmas large, lanceolate. Fruit 1 inch long, ovoid, black, breaking up into 3 two-valved cocci. Seeds ovoid-oblong, dull brownish-black, .7 inch long. *Physic-nut*. Vern. *Japlota* (Ka.).

Indigenous to Tropical America. Cultivated in the Sub-Himalayan tract and occasionally in the plains. Completely naturalized in the Kangra District. The plant is in Kangra much used for making hedges as its roots very readily from cuttings put in during the rains provided terminal shoots are used (*i. e.*; not pieces cut at both ends). It is not eaten by goats or cattle and seedlings spring up readily whenever the seeds get covered by soil. It likes a fairly moist situation but stands periodic droughts well. Owing to the ease with which it can be propagated this plant is worth trying for afforestation works

in the Sub-Himalayan tracts but it will not stand very dry situations in the plains. It would only be of use for shade under which other more valuable plants could be grown as it is useless for fuel or timber. The seeds yield an oil which is violently purgative. In flower or fruit all the year round.

JATROPHA GOSSEYIFOLIA, Linn.—A soft-wooded erect shrub 6 feet high. Leaves alternate, 2-4 inches long and broad, deeply 3- or 5-lobed, the margin closely set with stipitate yellow glands; petiole 2-4 inches long, bearing long-stipitate glands; stipules capillary, multifid, glandular. Flowers small, red, in glandular corymbose cymes. Bracts and sepals glandular-ciliate. Stamens 10-12, monadelphous. Capsule .5 inch long.

Native of Brazil. Cultivated in gardens occasionally. Grows spontaneously on the banks of the Sutlej above Rupar from Dhirpur to Nurpur but it does not appear to be naturalized elsewhere in the Punjab as yet. It is quite naturalized in many parts of India. The young foliage is a handsome dark-bronze color. The leaves are not eaten by goats. The plant gets nipped by frost in Lahore.

18. RICINUS, Linn.

(From the Latin *ricinus*, a tick; the name was given by the older botanists owing to the supposed resemblance between that animal and the seed. **DISTRIB.** Species only the following, probably originally African now naturalized in all warm countries.)

RICINUS COMMUNIS, Linn. *Sp. Pl.* (1753) p. 1007.—An evergreen soft-wooded shrub or occasionally a small tree. Leaves alternate, 9-18 inches long and broad, 7- many-lobed, palmate, peltate, lobes acuminate, serrate, teeth irregular, blunt; petiole stout, about as long as the blade; stipules 1 inch long, connate, leaf-opposed, caducous, leaving an annular scar. Flowers large, in terminal subpanicked racemes, monœcious, apetalous, the upper flowers female, the lower male. Male flowers; calyx 3-5-partite, lobes membranous, valvate; disk 0; stamens very numerous up to 1,000, arranged on about 5-8 repeatedly branched filaments, anthers globose, the cells separate; pistillode 0. Female flowers congested; calyx spatheo-cusly splitting, caducous; disk 0; ovary 3-celled; ovules 1 in each cell; style short or long, 2-fid, plumose. Fruit an echinate capsule, .8 inch long excluding the soft spines, breaking up into 3 two-valved crustaceous cocci. Seeds oblong, smooth, mottled. *Castor oil*. Vern. *Arand*.

Naturalized in the Sub-Himalayan tract up to 4,000 feet and in the adjacent plains. Not very common. Usually near villages. Prefers a sandy soil such as is found along streams and rivers but also grows in very dry barren places. Apparently not damaged by cattle or goats. Often cultivated in gardens and hedges and many different varieties are seen. Some have bluish glaucous stems and others bright crimson leaves, stems and petioles. The seeds are very poisonous but yield the well-known medicinal castor-oil which is much used for lubrication. The plant is of very rapid growth on loose porous soil but is short-lived. Flowers at various seasons.

BREYNIA RHAMNOIDES, Muell. Arg.—An evergreen shrub 4-8 feet high. Leaves alternate, distichous, close-set, 7-1 inch long, elliptic-ovate or suborbicular, glabrous; petiole .1 inch long; stipules short, setaceous. Flower monœcious, minute, greenish, in few-flowered axillary clusters; petals 0;

disk 0. Male flowers; calyx turbinate with 6 minute inflexed teeth; stamens 3, filaments united in a column, anthers linear adnate to the column; pistillode 0. Female flowers; calyx campanulate, 6-lobed, somewhat enlarged in fruit; ovary 3-celled, truncate; styles minute. Berry .25 inch diameter, red, globose, containing 3 two-seeded pyrenes.

Indigenous to the warmer parts of India. Cultivated in gardens in the plains. A very ornamental foliage plant almost hardy in Lahore, occasionally gets cut back by frost.

ALEURITES MOLUCCANA, Willd.—A large evergreen tree with smooth grey bark. Leaves alternate, 4-12 inches long, ovate, rhomboid-ovate or ovate-lanceolate, entire, or broader and palmately 3-7 lobed, stellately hairy when young; petiole 2-2.5 inches long, 2-glandular at the apex. Flowers monœcious, .4 inch across, in many-flowered terminal panicles. Male flowers; calyx subglobose, velvety, usually splitting into 3 valvate segments .1 inch long; petals 5, obovate-oblong, .25 inch long, bearded within; stamens 15-20, on a conical torus, the 5 outer opposite to the petals, alternating with 5 disk-glands; pistillode 0. Female flowers; perianth as in the male; disk much reduced; ovary 2-celled, hispid; ovules 1 in each cell; styles with 2 linear arms. Fruit a drupe 2-2.5 inches diameter, subglobose, fleshy, olive-colored, containing 1-2 large oily seeds. *The Indian Walnut.*

Indigenous to Malaya and the Pacific Islands. Cultivated in the plains. A handsome tree, grows well in Lahore. The seeds are edible and yield an oil used as a drying oil for paint. The seeds do not germinate till the second year after sowing. Flowers: April, May.

CROTON OBLONGIFOLIUS, Roeb.—A small deciduous tree, young leaves and inflorescence dotted with shining stellate scales. Leaves alternate, 6-12 inches long, oblong, elliptic or ovate-oblong, subcoriaceous, more or less toothed or repand; petioles .5-2.5 inches long. Flowers mon- or diœcious, green, in axillary and terminal racemes 5-12 inches long. Male flowers .3 inch across; calyx nearly .2 inch long, scaly, 5-fid; petals 5, elliptic-lanceolate, woolly; disk of 5 rounded glands; stamens 10-12, on a hairy torus, free; pistillode 0. Female flowers; sepals and petals similar to the male; disk annular; ovary 3-celled, scaly; styles 3, each 2-partite. Capsule .4 inch diameter, globose, 2-lobed, scaly.

Indigenous to Oudh and most parts of India. Cultivated in gardens in the plains. A handsome tree, leafless for a short time only, the leaves turning bright red before falling. Flowers: April.

EXCECARIA BICOLOR, Hassk.—An evergreen shrub 4-6 feet high. Leaves opposite, 3-4 by 1-1.3 inches, oblong acuminate, serrulate, glabrous, olive-green above, crimson beneath; petiole .2-.3 inch long. Flowers minute, inconspicuous, the female 2-3 together in small axillary or terminal racemes.

Cultivated in gardens and as a pot plant in the plains but does not do very well. Easily recognized by the color of its foliage. Only the female plant appears to be in cultivation. It is a native of Java.

SYNADENIUM GRANTII, Hook. f.—A small tree 8-10 feet high, deciduous, branchlets stout succulent. Leaves alternate, 3-7 by 1-2.5 inches, oblanceolate or obovate, entire, fleshy, minutely ciliate, otherwise glabrous, pale-green with darker veins, tapering from above the middle to a stout petiole .1-.3 inch long. The apparent flower .3 inch across, consisting of an entire cup-shaped red involucre with a rim-like gland surrounding an inner series of 5 fringed inflexed lobes. Male flowers consisting of a solitary stamens as in *Euphorbia*, with the female flowers or in a separate involucre. Female flower reduced to a naked ovary as in *Euphorbia*.

Indigenous to Tropical Africa. Cultivated in gardens in the plains. Grows readily from cuttings.

PEDILANTHUS TITHYMALOIDES, *Poit.*—An evergreen succulent sparingly branched shrub about 3 feet high, juice copious, milky. Leaves 1-2 inches long, ovate, entire, thick, midrib prominent beneath, subsessile. The apparent flowers 3 inch long, in terminal crowded cymes, involucre slipper-shaped. Male flowers 20-3 together, consisting of a solitary pedicelled stamen as in *Euphorbia*. Female flower long-pedicelled, central, solitary, declinate, reduced to a naked ovary as in *Euphorbia*.

Indigenous to S. America. Occasionally grown in gardens for borders of path; or as a pot plant.

LXXXIII. URTICACEÆ.

Herbs, shrubs or trees, usually with strong bast fibres, often with milky juice. Leaves usually alternate, often oblique or 3-nerved; stipules various. Flowers small or minute, bisexual, polygamous or more often unisexual, mon- or dicæcious, in cymes or clusters or crowded on the surface of a fleshy or hollow receptacle; bracts usually small or 0, sometimes involucre. Perianth simple, calycine, equally or unequally lobed or partite, lobes or segments imbricate or valvate. Stamens as many as and opposite the perianth-lobes or fewer; filaments usually free, erect or inflexed in bud; anthers 2-celled. Pistillode small or 0. Ovary superior, 1-celled; ovules solitary, erect or pendulous; style often excentric, simple or 2-fid with stigmatose arms or stigma sessile, plumose or penicellate. Fruit a drupe or samara or of small free achenes or compound as a confluent mass of perianths and pericarps. **DISTRIB.** A large family; chiefly tropical.

A. Plants with watery juice.

I.—Fruit a samara; leaves not 3-nerved.

Leaves serrate; cotyledons flat ... 1. *Ulmus*.

Leaves entire: cotyledons folded ... 2. *Holoptelea*.

II.—Fruit various, never winged; leaves 3-nerved (*Forskohlea* obscurely 3-nerved.)

1. Trees; fruit a drupe.

Leaves and shoots usually smooth or softly hairy; sepals imbricate ... 3. *Celtis*.

Leaves and shoots usually very rough; sepals induplicate-valvate ... 4. *Trema*.

2. Shrubs, fruit dry or succulent, never drupaceous.

(a) Flower clusters arranged in spikes ... 5. *Bahmeria*.

(b) Flower clusters not arranged in spikes.

- (i) Flowers not involu-
crate; leaves
acute or tailed, the
larger over 3 in-
ches long.

Fruit dry; stig-
ma filiform ... 6. *Pouzolzia*.

Fruit succulent;
stigma sessile
not filiform.

Leaves ovate
or elliptic,
green beneath 7. *Villebrunea*.

Leaves oblong-
lanceolate,
white beneath 8. *Debregeasia*.

- (ii) Flowers involu-
crate; leaves ob-
tuse, 5-1 inch
long ... 9. *Forskohlea*.

B. Plants with milky juice. (In some not copious and best seen by breaking the petiole.)

I.—Fruit a syncarpium formed from many flowers with their perianths and often with the bracts and receptacle.

1. Male flowers in catkin-like spikes.

Root-suckers copious; female flowers in globose heads; leaves often opposite ... 10. *Broussonetia*.

No root-suckers; female flowers in ovoid or cylindric spikes; leaves always alternate ... 11. *Morus*.

2. Male flowers arranged like the female on the inside of a hollow receptacle (fig) ... 12. *Ficus*.

II.—Fruit the result of one flower; leaves rough; male flowers in small globose heads ... 13. *Strellus*.

1. *Ulmus*, Linn. (*The Elms*).

(The Latin name of the Elm.)

Deciduous trees. Leaves alternate, distichous, serrate, penninerved; stipules lateral, scarious, variable in size. Flowers bisexual or mostly male, in clusters from the leaf-scars. Perianth campanulate, 4-8—usually 5-lobed, imbricate. Stamens as many as perianth-lobes, erect in bud. Ovary compressed; ovule pendulous; style shortly 2-fid or 2-partite,

branches stigmatose within to the base. Fruit a nut winged all round, wing obliquely orbicular, reticulate. **DISTRIB.** Species about 16; North temperate regions.

Mature leaves scabrid above, usually very oblique at the base; pedicels longer than the perianth; ovary and young fruits glabrous or nearly so. No root-suckers ... 1. *U. Wallichiana*.

Mature leaves smooth, subequal or slightly oblique at the base; pedicels shorter than the perianth; ovary and young fruits villous. Suckers freely 2. *U. laevigata*.

1. *ULMUS WALLICHIANA*, *Planch. in Ann. Sc. Nat. Sér. 3, X (1848) p. 277*.—A large tree, bark rough, shoots more or less pubescent when young. Leaves usually 3-6 inches long, elliptic, elliptic-oblong or obovate, long-acuminate, scabrid above, pubescent or glabrate beneath, base usually very oblique; lateral nerves prominent, parallel, 15-20 pairs, each ending in a large tooth the outer edge of which is serrate; petiole .2-.4 inch long, pubescent. Flowers numerous, in very short congested racemes, forming globose fascicles on the leafless branches; pedicels .2 inch long, jointed one-third the way up, the lower portion pubescent. Perianth rather over .1 inch long, narrowed into the pedicels; lobes 5-6, ciliate, obtuse, about as long as the tube. Ovary slightly hairy. Samara .6 inch long, orbicular, glabrous or nearly so, contracted suddenly into a short stipe longer than the perianth. *Big-leaved Elm*. Vern. *Káin* (Haz.) *Maral*, *Mareen* (Ku.).

Himalaya 6-10,000 feet from the Indus to Nepal. Also Trans-Indus but there apparently less common than other species. Usually a large tree with straight little-branched trunk and not producing root-suckers. The wood is yellowish-brown with a handsome grain and takes a beautiful polish. It would be an excellent furniture wood but is not available in large quantities and is in inaccessible localities. Found in moist ravines and patches of broad-leaved forest. It is much lopped for fodder. Flowers: March—April.

2. *ULMUS LÆVIGATA*, *Royle, Illustr. Bot. Himal. (1839) p. 341*.—A medium-sized or large tree, usually minutely pubescent when young and villous in the leaf-axils. Leaves 1.5-4 inches long, the smaller broadly ovate, the larger elliptic-oblong, acuminate, smooth above, glabrous beneath when mature except for tufts of hairs in the axils of the nerves, usually slightly oblique at the base; lateral nerves 10-14 pairs, each ending in a large tooth the outer edge of which is serrate; petiole .1-.3 inch long. Flowers numerous in dense sessile fascicles; pedicels .03 inch long (.1 inch long in fruit, jointed one-third the way up.) Perianth .12 inch long, jointed on to the pedicel (the base of the perianth-tube lengthening after flowering and leaving the joint below the middle), lobes 5, obtuse. Ovary and style densely villous. Samara (unripe) .3 inch long, elliptic, tipped by the large styles and contracted into

a short stipe not longer than the perianth, very hairy especially on the edges. *U. villosa*, Brandis, Ind. Trees, fig. 185. *Small-leaved Elm*. Vern. *Mammu* (Haz.) *Marn* (Ku. Bash.).

Himalaya 3,500-10,000 feet from the Indus to the Jumna. Also in Baluchistan (cult?). In Hazara it is found usually at low elevations and is often cultivated. The seed drops before ripening and the tree is probably propagated by suckers which it produces freely. In Kulu and Bashahr it is cultivated and lopped for fodder. It is perhaps not indigenous as it has not been collected with ripe fruit, and it is possible that it is maintaining itself by vegetative reproduction as does *U. campestris* in England. Reaches a very large size on good soil and is more branched and more leafy than *U. Wallichiana*. Flowers: February—March.

ULMUS CAMPESTRIS, Linn.—A tree with the foliage of *U. Wallichiana* but the leaves usually rather smaller and with fewer nerves. The inflorescence resembles that of *U. lavigata*. The samara is glabrous. *The Common Elm* (of England).

Indigenous to Europe and Western Asia. Cultivated at Ghoragali, Rawalpindi District. The twigs often have wings of cork as may be seen at Ghoragali. It produces root-suckers freely and for this reason might be useful for filling up firewood coupes in the hills. It suffers somewhat from snow-break.

2. HOLOPTELEA, Planch.

(From the Greek *holos*, entire, and *ptelea*, the Elm; the tree differs from *Ulmus* in having entire leaves. **DISTRIB.** Species only the following in India, Ceylon and Cochin China.)

HOLOPTELEA INTEGRIFOLIA, Planch. in *Ann. Sc. Nat. Sér.* 3, X (1848) p. 266.—A large deciduous tree, bark pale-grey nearly smooth, young shoots pubescent. Leaves alternate, 2-4 by 1·5-2·5 inches, elliptic, acuminate, entire (or in young trees and seedlings toothed), base rounded or subcordate, glabrous above, often pubescent beneath when young; lateral nerves 5-8 pairs; petiole ·2-·4 inch long; stipules linear, caducous. Flowers green, bisexual or male, in very numerous fascicles or short racemes on the leafless branches at the leaf-scars. Perianth of 4-8 sepals, ·07-·1 inch long, pubescent, imbricate. Stamens 4-8; anthers pubescent. Ovary long-stipitate, compressed; ovules pendulous; style 2-fid, the branches stigmatose within to the base. Samara 1 inch diameter, nearly orbicular, on a slender stipe ·1-·2 inch long, pedicel ·2-·3 inch long, jointed below the scars left by the fallen sepals and stamens, wing membranous veined notched between the styles, *Indian Elm*. Vern. *Rajáin* (Ka.) *Pápri* (Siml.)

Sub-Himalayan tract from Jammu eastwards. Common in Kangra at low elevations. Much lopped for fodder. Often grown as a roadside tree for which purpose it is excellent. It is grown in the plains of the East Punjab and is common near Delhi but in Lahore it suffers considerably from frost. When well grown it is a handsome shady tree requiring little moisture and reaching a large size but on poor rocky ground it is a medium-sized or small tree branchy, crooked and often hollow. The growth is fast. The wood is yellowish-grey, moderately hard, it is not used. Flowers: February—March, when leafless.

3. *CELTIS*, Linn.

(A classical name used by Pliny for the Lotus; it is not clear why it is applied to this genus. *DISTRIB.* Species 50-60; many of them separated by very indefinite characters; temperate and tropical, chiefly in the northern hemisphere.)

CELTIS AUSTRALIS, Linn. *Sp. Pl.* (1753) p. 1043.—A small to fairly large deciduous tree, bark bluish-grey smooth with small horizontal wrinkles in large trees, young shoots glabrous or more or less tomentose. Leaves alternate, variable, usually 2-4 inches long, elliptic, ovate or ovate-lanceolate, acuminate, subentire or serrate, usually glabrous but sometimes (especially in Western specimens) scabrid above, glabrous or pubescent or almost tomentose beneath, base oblique, strongly 3-nerved; petiole .2-.5 inch long; stipules .3 inch long, linear, caducous. Flowers .2 inch across, greenish, male and bisexual. Male flowers in lateral fascicles or short racemes in the axils of the lowest leaves or below them; pedicels .1 inch long. Sepals 4-5, broadly oblong, .1 inch long, obtuse, hairy on the backs and woolly on the margin, imbricate. Stamens 4-5, short, erect in bud, surrounding a woolly torus. Bisexual flowers axillary, 1-3 together; pedicels .3-.5 inch long. Sepals and stamens as in the male. Ovary sessile, woolly at the base or all over; ovule pendulous; style-arms 2, long, plumose. Drupe usually solitary, .3 inch long, ovoid, woolly at the base and sometimes all over, pedicels .5-2 inches long, slender. Stone reticulately rugose. *C. caucasica*, Willd., *C. eriocarpa*, Dene. *Nettle tree*. Vern. *Kharak, khirk, bathkarar* (Haz.).

Himalaya 2-8,500 feet. Extending to Kunwar, Pangi and Kagan. Salt Range. Trans-Indus. Frequent both in the forest and cultivated. It is much lopped for fodder. Also frequently cultivated in the plains and grows well. There are many forms of this variable tree, at low elevations and in dry rocky places the leaves are smaller more coriaceous and as a rule more entire. The more entire leaved specimens are I think not distinguishable from those from Central and Eastern India referred to *C. tetrandra*, Roxb. They are found up to 6,000 feet but are not sharply distinguishable from the typical sharply serrate larger leaved forms which are found as low as 4,500 feet. The fruit varies in size and color. Brandis mentions two forms one with a large purplish-black fruit .5 inch long and the other with yellow or red fruits .3 inch long. The wood is good, strong and tough but it is very little used. It is excellent for tool-handles and similar purposes, it is fairly hard, close and ever-grained, grey or yellowish-grey. Fruit edible. Flowers with or just before the young leaves in March-May.

4. *TREMA*, Lour.

(From the Greek *trema*, a hole; referring to the minutely pitted stone.)

Trees or shrubs. Leaves alternate, serrate, 3-7-nerved; stipules caducous. Flowers monœcious, diœcious or polygamous, in small axillary cymes. Perianth calycine, sepals 4-5, induplicate-valvate or subimbricate. Stamens 4-5, erect in

bud, exceeding the perianth. Ovary sessile; ovule pendulous; style terminal, arms 2, linear. Fruit a small ovoid drupe; endocarp hard. **DISTRIB.** Species about 20; tropical and subtropical.

Leaves rough on both sides; male cymes compact,
not longer than the petiole ... 1. *T. politoria*.

Leaves softly tomentose beneath; cymes spreading,
longer than the petiole ... 2. *T. orientalis*.

1. *TREMA POLITORIA*, *Planch. in Ann. Sc. Nat. Sér. 3*, X (1848) p. 326.—A small tree 15 feet high, branchlets scabrid. Leaves 2·5 by 1·5 inches, oblong or ovate-lanceolate, acuminate, serrulate, base rounded or subcordate, subcoriaceous, very hard and scabrid on both sides, base 3- or obscurely 5-nerved; petiole 2·4 inch long; stipules 4 inch long, linear. Flowers minute, greenish, cymes of male flowers as long as or shorter than the petiole. Male flowers; sepals less than 1 inch long, elliptic-lanceolate, margins woolly. Pistillode glabrous, truncate, on a woolly torus. Female flowers; sepals as in the male but rather smaller and acute. Stamines 0. Ovary glabrous, exserted, on a woolly torus. Drupe 1·15 inch long, seated on the persistent calyx.

Sub-Himalayan tract and outer Himalaya ascending to 3,000 feet from the Rawalpindi District eastwards. Salt Range. A plant of very rapid growth. Found on landslips along the banks of ravines also on the edges of streams. It is common fringing the Jhelum in the Rawalpindi District and extending up the side streams. Wood fairly hard, brownish. The bast fibres are used for making ropes. The leaves are exceedingly rough and can be used instead of sand-paper. The tree should be tried for afforestation in places like the Hoshiarpur Siwaliks. Flowers: April—June.

2. *TREMA ORIENTALIS*, *Blume, Mus. Bot. II* (1856) p. 62.—A small tree reaching 30 feet, branchlets pubescent. Leaves 3·6 by 1·2·5 inches, ovate or ovate-lanceolate, caudate-acuminate, more or less scabrid above, white- or silky-tomentose beneath, base 3·7-nerved, often cordate; petiole 2·5 inch long; stipules 2 inch long, silky, acute. Cymes lax, spreading, longer than the petioles. Otherwise as for *T. politoria*.

Kangra District (according to Lace's list in the Kangra Working Plan). I have seen no Punjab specimens. This plant much resembles *T. politoria* but in that species the mature leaves are at most slightly hairy on the main nerves beneath, never tomentose. Flowers: April June (in Dehra Dun).

5. *BOEHMERIA*, *Jacq.*

(In honor of G. R. Boëmer, a German botanist of the 18th century.)

Shrubs or small trees. Leaves alternate or opposite, toothed, 3-nerved; stipules usually free, deciduous. Flowers monœcious or dicœcious, in unisexual axillary spicate or paniculate clusters; bracts small, scarious. Male flowers; perianth

3-5-lobed or -partite, valvate; stamens 3-5, inflexed in bud; pistillode clavate or globose. Female flowers; perianth tubular, 2-4-toothed, sometimes angled, winged or swollen in fruit; ovary included; ovule erect; stigma filiform, persistent. Fruit a crustaceous achene at first closely invested by the perianth, at length free. **DISTRIB.** Species about 45; chiefly tropical.

- | | | |
|--------------------------|-----|----------------------------|
| A shrub. Leaves opposite | ... | 1. <i>B. platyphylla</i> . |
| A tree. Leaves alternate | ... | 2. <i>B. rugulosa</i> . |

1. *BØHMERIA PLATYPHYLLA*, *D. Don, Prodr. Fl. Nep.* (1825) p. 60.—A shrub usually 3-4 feet high, occasionally 10 feet, bark fibrous, dark-brown. Leaves opposite, 3-9 by 2·5-7 inches, broadly ovate or suborbicular, acuminate or shortly caudate, regularly dentate, base rounded truncate or cordate, more or less rough and scabrid on both sides; petiole 1-8 inches long. Flowers nearly white, in clusters forming interrupted axillary spikes often longer than the leaves, males and females in separate spikes on the same or on different plants, 4-merous in both sexes. Achenes ·05 inch long, pale-brown, compressed.

Sub-Himalayan tract and outer Himalaya from the Ravi eastwards. In moist shady places, roadsides, banks of streams, &c. Ascends to 5,000 feet in the outer hills. The bark yields a strong fibre. Flowers: July—September.

2. *BØHMERIA RUGULOSA*, *Wedd. in Ann. Sc. Nat. Sér. 4, I* (1854) p. 200.—A small tree or large shrub, bark on old stems dark-brown, rough. Leaves alternate, 3-6 by 1-2 inches, elliptic-oblong or -lanceolate, acute, or acuminate, crenate or bluntly serrate, glabrous and dark-green above, pale and velvety beneath, longitudinally 3-nerved almost to the tip, the nerves penniveined, the lateral veins of the midrib anastomosing in a marked manner with those on the inside of the two side nerves, the lateral veins on the outside of the side nerves joined by an intramarginal vein running close to the edge of the leaf; petiole ·5-1·5 inches long; stipules connate between the petiole and the stem. Flowers dioecious, in clusters, each cluster in the axil of a cordate bract, the clusters arranged in simple axillary spikes 2-6 inches long. Achenes ·08 inch long, elliptic, narrowed at both ends, compressed, ciliate towards the top.

Sub-Himalayan tract from the Kangra District eastwards. (Fide Lace, Kangra Working Plan). I have seen no Punjab specimens in herbaria but the tree is common in the Simla Hills near Kalka. The tree is quick-growing and produces a smooth red even-grained wood excellent to work and used for carving bowls, cups, etc. Grows well on steep ground but is probably not easy to grow artificially owing to the minute size of the seed. Flowers: July—September.

6. *POUZOLZIA*, Gaud.

(In honor of P. M. C. de Pouzol, a French botanist of the 19th century.
DISTRIB. Species about 35; mostly in the tropics of the Old World.)

POUZOLZIA VIMINEA, Wedd. in DC. Prodr. XVI i (1869) p. 228.—An erect shrub with slender branches, pubescent or strigose. Leaves alternate, 2-5 inches long, lanceolate, ovate- or oblong-lanceolate, caudate-acuminate, dentate with large teeth, smooth or somewhat rough above, strigose on the nerves beneath; basal nerves 3, extending more than half the length of the leaf; petiole .5-2 inches long; stipules .15 inch long, obliquely ovate, acuminate, membranous, with a hairy midrib. Flowers minute, usually monœcious, in dense axillary clusters with numerous ovate bracts. Male flowers; perianth 4-partite, segments valvate, strigose outside; stamens 4, inflexed in bud. Female flowers; perianth ovoid, narrowed at the obscurely toothed mouth; ovary 1-celled; ovules erect; stigma filiform, deciduous. Fruit an achene, enclosed in the persistent perianth which is angled or obscurely margined.

Valleys in the Himalaya from Chamba eastwards (Fide Collett, Fl. Siml., p. 467). I have seen no Punjab specimens. The plant is variable, in some forms the leaves are grey- or white-tomentose beneath. This plant is apt to be mistaken for *Villebrunea frutescens* which has relatively broader more reticulate leaves and a sessile stigma. In *Villebrunea* the flowers are in the axils of fallen leaves whereas in *Pouzolzia viminea* the leaves subtend the flower-clusters. Flowers: July—September.

7. VILLEBRUNEA, Gaud.

(Evidently named after a person of whom nothing is known. **DISTRIB.** Species 8; India to Japan.)

VILLEBRUNEA FRUTESCENS, Blume, Mus. Bot. II (1856) p. 168.—A slender shrub with dark-brown or grey bark, young shoots pubescent. Leaves alternate, 3-6 inches long, ovate or elliptic, caudate-acuminate, serrate, membranous, somewhat hispid on both surfaces, pale but green beneath, base 3-nerved, the nerves extending more than half the length of the leaf; petiole .5-4 inches long, slender; stipules .5 inch long, lanceolate, acuminate, membranous, midrib hairy. Flowers minute, dioecious, in lateral clusters in the axils of the fallen leaves. Male flowers; perianth 4-partite, segments ovate, valvate, hairy outside; stamens 4, inflexed in bud. Female flowers; perianth ovoid, narrowed to the obscurely toothed mouth; ovary 1-celled; ovule erect; stigma sessile, peltate, fimbriate. Fruit a number of achenes half immersed in the thickened fleshy succulent bracts.

Sub-Himalayan tract ascending to 5,000 feet in the Himalaya from the Indus eastwards. Common along rocky banks of streams and water channels usually as quite a small shrub. The bark contains a strong fibre. Flowers March—September.

8. DEBREGIASIA, Gaud.

(Evidently named after a person of whom nothing is known. **DISTRIB.** Species 5; Abyssinia, S. Asia to Japan.)

DEBREGEASIA HYPOLEUCA, Wedd. *Monogr.* (1856) p. 463. t. 15, A, f. 10, 11.—A large evergreen shrub, young shoots grey-tomentose. Leaves alternate, 3-8 by $\cdot 5\text{--}2$ inches, oblong-lanceolate, acuminate, serrulate, slightly scabrid above, white-tomentose beneath, base 3-nerved the nerves extending more than half the length of the leaf; petiole $\cdot 2\text{--}1\cdot 5$ inches long, tomentose; stipules $\cdot 3$ inch long, membranous, connate between the petiole and the stem, tips free, midrib hairy. Flowers dioecious, small, crowded with bracteoles in sessile clusters, usually in the axils of fallen leaves. Male flowers; perianth 4-partite, tomentose outside, segments valvate; stamens 4, inflexed in bud. Female flowers; perianth ovoid, mouth narrowed, obscurely 4-toothed; ovary 1-celled; ovule erect; stigma sessile, resembling a tuft of hairs. Fruit yellowish, resembling a small raspberry, consisting of a number of achenes contained in the fleshy perianths. Vern. *Chanjāl* (Haz.), *Siāru*.

Sub-Himalayan tract ascending to 6,000 feet in the Himalaya, from the Indus eastwards. Also in the inner valleys. Salt Range. Changa Manga, introduced by canal water. Common in moist or wet places. The bark yields a fibre used for ropes. The fruit is edible. Flowers: March—May.

9. *FORSKOHLEA*, Linn.

(In honor of Petrus Forskal, author of the *Flora Ægyptiaco-Arabica* in 1775. **DISTRIB.** Species 5; India, Arabia, Africa to Spain.)

FORSKOHLEA TENACISSIMA, Linn. *Mant.* (1767) p. 72.—A more or less woody undershrub 6 inches to 2 feet high, branches hispid and finely tomentose. Leaves alternate, $\cdot 5\text{--}1$ inch long, rhombic, orbicular or obovate, obtuse, sinuate or bluntly toothed, base cuneate, rough above with hooked hairs sometimes mixed with deciduous fluffy tomentum, ciliate, white-tomentose beneath and hispid on the nerves, 3-nerved from close above the base; petiole $\cdot 2\text{--}5$ inch long; stipules ovate, acute, scarious, ciliate. Flowers monœcious, in axillary involucre, the males at the margin, the females 1-4 in the centre; bracts $\cdot 2$ inch long, usually 5, oblanceolate, hispid above, silky towards the base, densely woolly within. Male flowers; perianth clavate in bud, irregularly 3-lobed in flower, one lobe inflexed; stamen 1, inflexed in bud. Female flowers; perianth 0; ovary 1-celled; ovule erect; stigma filiform, hispid, persistent. Achene $\cdot 1$ inch long, ovoid, compressed, tapering into the filiform stigma.

Punjab plains; Attock. Salt Range. Trans-Indus. Flowers: April—May.

10. *BROUSSONETIA*, Vent.

(In honor of P. N. V. Broussonet, a French naturalist, who found the female tree in gardens in Scotland and introduced it into Paris where the male tree was grown, thus enabling the fruit to be described. **DISTRIB.** Species 3-4; Upper Burma to Japan, Pacific Islands.)

BROUSSONETIA PAPYRIFERA, Vent. Tab. Rég. Vég. III (1794) p. 547.—A fairly large deciduous tree, bark smooth grey, shoots pubescent when young. Leaves opposite and alternate, 3-8 by 2-6 inches, very variable, from very deeply lobed to unlobed, ovate, acuminate, crenate-dentate, base often oblique, scabrous above, softly tomentose beneath; petiole 1·5-4·5 inches long; stipules ·6-·8 inch long, obliquely ovate, caducous. Flowers dioecious, axillary. Male flowers yellowish, in catkin-like spikes 3-6 inches long. Perianth campanulate, hairy, 4-fid, segments valvate. Stamens 4, inflexed in bud. Female flowers reddish, in globose pedunculate heads about ·5 inch diameter (excluding the styles) the flowers mixed with persistent hairy clavate bracts. Perianth ovoid, inconspicuously 2-4-toothed. Ovary stipitate, included; ovule pendulous; style long, filiform, pink. Fruit a head of achenes raised above the globose mass of bract on fleshy stalks, red when ripe. Brandis, Ind. Trees, fig. 189. *Paper Mulberry*.

Indigenous to China and Upper Burma. This tree was introduced into Northern India (Saharanpur) in 1880 and it has done well wherever tried provided it can get a sufficient supply of moisture. It is likely in time to become common in the Sub-Himalayan tract as well as in the more heavily irrigated portion of the plains but has scarcely had time to spread very much as yet. It has spread considerably in Lahore during the last 10 years and is found growing along irrigation channels and in moist neglected corners. It has also found its way into Shahdara plantation. The wood is soft greyish-white, rather perishable. The inner fibre of the bark is used to make paper in Japan and cloth in the South Sea Islands. The bark is excellent for paper but at Lucknow it has been found that the cost of collection is nearly as great as the price obtainable for it. The growth is exceedingly rapid on good moist soil. In Lahore it reaches 60 feet in height and 2-3 feet in girth in 7 years but the tree is brittle and constantly breaks off and then rot gets into the timber and the whole tree is soon destroyed. Reproduces freely from seed in moist places where there is not already a heavy growth and throws up root-suckers in great abundance. It can also be readily grown from cuttings put in in December. It would probably be a useful tree for villagers to grow and lop for fodder in moist tracts such as the Kangra District. The tree is remarkable for the variety of climates in which it can be grown, as it is hardy out of doors in Europe, but the growth in a cool climate is not nearly so vigorous as in a hot one. Flowers: March.

11. *MORUS*, Linn. (*The Mulberries*).

(The classical name of the mulberry.)

Trees or shrubs. Leaves alternate, ovate, often lobed, 3-nerved; stipules lateral, lanceolate, deciduous. Flowers, monoecious or dioecious. Male flowers in catkin-like spikes; sepals 4, imbricate; stamens 4, inflexed in bud; pistillode minute. Female flowers in cylindric spikes or ovoid heads; sepals 4, accrescent and succulent in fruit; ovary 1-celled; ovule pendulous; styles 2, free or connate. Fruit a spike or head of achenes each enclosed in the succulent perianth, the whole forming a compound berry (mulberry). **DISTRI-**

Species 6-10; tropical and warm temperate regions of the Northern Hemisphere.

Teeth of leaves uniform usually blunt; segments of the perianth of female flowers 4, the two outer keeled ... 1. *M. alba*.

Teeth of leaves usually coarse, somewhat unequal and sharp; segments of the perianth of female flowers 2-4, usually 3, all similar ... 2. *M. serrata*.

1. *MORUS ALBA*, *Linn. Sp. Pl.* (1753) p. 986.—A medium sized deciduous tree; bark of large stems brown, rough, fissures mostly vertical. Leaves very variable in size and shape, usually 2-3 inches long, ovate, obtuse, acute or shortly acuminate, serrate or crenate-serrate, base cordate or truncate, slightly pubescent along the nerves beneath, in young plants and on vigorous shoots usually lobed, basal nerves 3, lateral nerves forked near the margin; petiole usually .7-1 inch long. Flowers greenish, the sexes often on different branches occasionally on different trees. Male spikes .5-1.5 inches long, puberulous, flowers minutely pedicellate, not crowded. Sepals .1 inch long, hairy. Female spikes ovoid, pedunculate, the peduncle as long as the spike; sepals 4, glabrous or shortly ciliate; style-arms glabrous or nearly so, free to the base. Fruit up to 1 inch long, usually less, ovoid, white or nearly black when ripe, the latter form red when not fully ripe. The *Mulberry*. Vern. *tūt*.

Probably indigenous to China. Now naturalized in Western Asia, South Europe and the United States. The mulberry has been cultivated from a very remote time in Northern India, but it seems to have spread as a naturalized tree in comparatively recent years, being encouraged by the great extension of irrigation. In the Himalaya it is cultivated up to 11,000 feet but is not found growing spontaneously except at low elevations, and even in the Sub-Himalayan tract it is more commonly seen as a planted than as a wild tree. In the plains it is also very frequently cultivated and seedlings spring up readily especially in moist and shady places where they are protected from browsing. It has been introduced by water or birds into all the Sissoo plantations of the Punjab, both inundated such as those at Jhelum, Shahdara and Ludhiana, irrigated as Changa Manga and dry as Phillaur. Sometimes it is only seen as an undergrowth but at other times it forms the entire stock having completely ousted the Sissoo. The spread of the mulberry at the expense of the Sissoo is due to its more rapid growth in early youth though it does not reach the ultimate height attained by Sissoo. The growth from coppice is very vigorous. The mulberry is a shade-bearing species doing best with a certain amount of shelter in hot places. In Changa Manga it suffers a good deal from wind-break especially where it is growing pure, and if suddenly exposed and left as a standard it suffers from the sun as well.

The timber is used for many purposes for which ash is used in Europe especially in the manufacture of sporting requisites. The chief market is Sialkot where it is used for the bent frames of tennis and badminton rackets, hockey sticks and cricket stumps. It fetches about 14 annas a cubre foot. The mulberry in the Shahdara plantation is much damaged for timber purposes by a longicorn, *Apriona germari*, Hope, which in the larval stage bores into the wood forming tunnels 7-8 feet long and as thick as the finger. This beetle is fortunately unknown at present in Changa Manga. The mulberry flowers with the young leaves in March-April.

2. *MORUS SERRATA*, *Roxb. Hort. Beng.* (1814) p. 103.—A large deciduous tree, bark reddish or greyish-brown, smooth on young, scaly on old stems. Leaves variable, usually 3-6 inches long, broadly ovate, acuminate or caudate, often lobed, usually coarsely sharply serrate, teeth usually unequal, cuspidate, base rounded truncate or cordate, 3- or 5-nerved, pubescent or tomentose when young, rather rough when mature and glabrous except along the nerves beneath, lateral nerves or their branches running nearly straight to the tips of the teeth; petiole usually 1-2 inches long. Flowers diœcious. Male spikes 1·5-3 inches long, dense, villous; sepals ·15 inch long, villous. Female spikes ·4-·5 inch long, shortly cylindric, peduncle ·1-·2 inch long, villous; sepals 2-4 usually 3, equal, ciliate; styles connate, very hairy. Fruit ·7-1 inch long, sweet, purple. Vern. *Karun*, *Kimu*.

Himalaya 4-9,000 feet. Trans-Indus to Kumaon, principally in the inner ranges. Not common. Frequently cultivated in Bashahr and lopped for fodder. Sometimes planted for shade near temples, &c., and makes a handsome tree reaching a very large size. Stewart notes one in Chamba of 28 feet girth. A height of 60-70 feet with a girth of 9-10 feet is not uncommon. The heartwood is yellowish-brown, darkening on exposure, it is easily worked, not heavy and takes a beautiful polish. It would make an excellent furniture wood if it were available in larger quantity and in more accessible places. The fruit is sweet and edible but it is not used to the extent of *M. alba* and the tree is usually so heavily lopped that no fruit is produced. Flowers: April—May.

MORUS LEVIGATA, *Wall.*—A large deciduous tree. Leaves usually 3-5 inches long, broadly elliptic-ovate, usually caudate-acuminate, sometimes obtuse, usually finely crenate-serrate, base truncate or cordate often oblique, rather firm and almost coriaceous when mature, base 3-nerved, lateral nerves when near the margin curving sharply towards the apex of the leaf. Spikes of both sexes long, cylindric. Female 1 inch or more in length, longer in fruit, peduncle and rachis villous; styles long, nearly free, papillose. Fruit 2-3 inches long, greenish, becoming nearly white when ripe, or red turning dark-purple, very sweet, insipid.

Cultivated in the plains and also in Abbottabad. I have not seen it wild but always budded on to *M. alba*. The bark is grey and much smoother than that of *M. alba* and the junction of scion and stock is very marked in a big tree. Apart from the differences in bark and flowers the leaves are larger broader and firmer than those of *M. alba*. They are nearly always unlobed in the white-fruited form but frequently lobed in the purple-fruited form. Flowers diœcious, March.

MORUS INDICA, *Linn.*—A tree differing from *M. alba* in the following characters none of which appear to be quite constant:—Leaves truncate or rounded at the base or some slightly cordate, narrowed into an acuminate apex but by no means always caudate-acuminate. Female spikes shortly ovoid, ·2-3 inch long, usually distinctly shorter than their peduncles. Styles long, hairy or papillose, connate for one-fourth their length. Fruit ·5 inch long, black when ripe.

Wild in the Sub-Himalayan tract from the Sutlej eastwards, according to Brandis, but I have seen no specimens from the Punjab except from cultivated plants. It is rarely cultivated in the Punjab but there are several specimens in the Race Course Road, Lahore. The leaves are mostly smaller than in

M. alba and the bark is slightly less fissured. It appears to be always dioecious. In Lahore it flowers at the end of February when *M. alba* is still quite leafless. Figured in Wight, *Icones*, tab. 674.

MORUS ATROPURPUREA, Roeb.—This is I think a form of *M. indica* improved by cultivation. The leaves are larger than in *M. indica* and the female spikes are much longer and stouter. Fruit 1-2 inches long, .5-.7 inch thick, red, turning dark-purple when ripe, succulent, edible. Introduced from China. Like *M. indica* this tree is dioecious, the fruits ripening without fertilization. It flowers in Lahore with *M. indica* and some time before *M. alba*. The fruit is the best of the mulberries grown in the plains. Figured in Wight, *Icones*, tab. 677.

12. *FICUS*, Linn. (*The Figs*.)

(The classical name of the cultivated fig, *F. Carica*.)

Trees or shrubs, erect and often epiphytic when young, sometimes sending out aerial roots or climbing by means of adventitious roots, juice milky. Leaves alternate, rarely opposite, entire, serrate or lobed; stipules covering the leaf-bud, often very large, caducous, usually leaving an annular scar. Flowers minute, 1-sexual, crowded together usually with thin-bracteoles on the inner surface of a hollow, globose or pear-shaped receptacle (fig) usually with 3-4 bracteoles at the base of the receptacle the mouth of which is closed by numerous overlapping scales. Receptacles axillary or on tubercles from the main stem and larger branches or on special leafless shoots arising from the main stem from near its base. Male flowers; perianth 3-5-fid or -partite; stamens 1 or 2, rarely 3-6, erect in bud. Neuter flowers; long pedicelled with a 3-leaved perianth. Pseudo-bisexual flowers; perianth of the male with both stamens and pistil. Female flowers; perianth similar to the male; ovary straight or oblique; ovule pendulous; style excentric; stigma entire or 2-fid, acute or obtuse. Gall-flowers; perianth as in the female, ovary empty or containing the egg or pupa of an insect; style short. Fruit, the enlarged receptacle the inner wall of which is studded with achenes (in fertilized fruit).
DISTRIB. Species about 600; mostly tropical.

Pseudo-bisexual flowers appear to function as gall flowers and not to produce seed, they are not found in the Punjab species. In *F. bengalensis*, *religiosa*, *Rumphii*, *infectoria* and *nemoralis*, male, female and gall-flowers all occur in the same receptacles. In the other species the male and gall-flowers are found in one set of receptacles and the female in another set, the two sets being externally quite similar. The figs are visited by Hymenopterous insects belonging to the Chalcidæ which lay their eggs in the gall-flowers. The mature insects escape into the cavity of the receptacle by cutting their way through the coat of the false achenes which the gall-flowers produce. At the time the insects emerge the male flowers are shedding their pollen and being situated in most species near the mouth of the receptacle are passed by the insects on their way out of the receptacle, which is usually by a tunnel cut through the bracts closing the mouth. The male insects are wingless but have powerful jaws and cut the tunnel through the bracts by which the insects escape from the receptacle. The female insects on escaping from the receptacle fly away in search of young receptacles in which to lay their eggs. These they enter by

forcing their way between the scales which overlap and protect the mouth of the young figs. Having entered the cavity they lay their eggs in the gall-flowers should such be found in the receptacle entered and die inside, the remains being easily recognized in the ripe figs. Many if not all of the following species produce two (possibly more) crops of ripe figs annually, either on the same or on different trees; this enables the insects to pass through a second generation in the year. The usual and obvious interpretation to put to the phenomena is that the insects effect pollination. This is supported by the fact that exotic species of figs do not produce seed nor do isolated trees if the insects are absent as each species of fig has its own species of insect which as far as is known can only breed in one kind of fig. On the other hand Cunningham (On the Fertilization of *Ficus Roxburghii*, Ann. Bot. Gard. Calc., I) found that a receptacle containing the corpse of a single insect had 12,700 enlarged ovaries and it is inconceivable that the insect carried anything like 12,700 pollen-grains. Moreover the bracts closing the mouth of the receptacle are sticky and present a considerable obstacle to the entrance of the insects and probably remove most of the pollen with which they are dusted on leaving the receptacle in which they were bred. Cunningham concludes that the insects act as a stimulus and that the fertilization is not an ordinary sexual process.

The wood of the figs is usually soft, grey or light-reddish or brownish, composed of bands of soft and harder tissue. It is not durable and does not burn well. It lasts well under water and is sometimes used for well-curbs.

1	{ Erect trees or shrubs	...	...	2	
	{ Climbing shrubs	...	...	14	
2	{ Leaves alternate	...	...	3	
	{ Leaves opposite	...	...	7.	<i>F. hispida.</i>
3	{ Figs axillary	...	...	4	
	{ Figs on special leafless branches or in clusters	...	...	12	
	{ on the old wood	...	...	11	
4	{ Leaves entire, smooth	...	...	5	
	{ Leaves toothed at least towards the top or	...	...	11	
	{ rough if entire	...	...	11	
5	{ Figs sessile	...	...	6	
	{ Figs pedunculate	...	...	9	
6	{ Petiole jointed to the blade	...	...	7	
	{ Petiole not jointed to the blade	...	...	1.	<i>F. bengalensis.</i>
7	{ Leaves broad, caudate-acuminate; ripe figs	...	...	8	
	{ black	...	...	8	
	{ Leaves ovate, acuminate; ripe figs white	...	...	4.	<i>F. infectoria.</i>
8	{ Acumen short, petiole channelled or flattened	...	...	2.	<i>F. Rumphii.</i>
	{ Acumen long, petiole terete	...	...	3.	<i>F. religiosa.</i>
9	{ Ripe figs white	...	...	4.	<i>F. infectoria.</i>
	{ Ripe figs orange or reddish	...	...	10	
10	{ Figs 1-1.5 inches diameter	...	...	13.	<i>F. glomerata.</i>
	{ Figs 2-3 inch diameter	...	...	11.	<i>F. nemoralis.</i>

- | | | | | | |
|----|---|--|-----|----------------------|----------------------------|
| 11 | { | Leaves oblong-lanceolate, petiole .2-.3 inch long | ... | ... | 5. <i>F. clavata</i> . |
| | | Leaves broadly ovate or lobed, petiole 1-2 inches long | ... | ... | 10. <i>F. palmata</i> . |
| | | | | | |
| 12 | { | Leaves very unequal-sided at the base | ... | 6. <i>F. Cunia</i> . | |
| | | Leaves symmetrical or nearly so at the base | ... | 13 | |
| 13 | { | Basal nerves 3 | ... | ... | 13. <i>F. glomerata</i> . |
| | | Basal nerves 5-7 | ... | ... | 12. <i>F. Roxburghii</i> . |
| 14 | { | Figs .3 inch diameter on .3-.6 inch peduncles | ... | ... | 8. <i>F. scandens</i> . |
| | | Figs .6 inch diameter on .1-.5 inch peduncles | ... | ... | 9. <i>F. foveolata</i> . |

1. *FICUS BENGALENSIS*, Linn. *Sp. Pl.* (1753) p. 1059.—

A large evergreen tree producing numerous aerial roots from the branches which if they reach the ground thicken rapidly and form supports to the crown; bark grey, smooth, young parts softly pubescent. Leaves 4-8 by 2-5 inches, ovate or elliptic, entire, obtuse, coriaceous, base rounded subcordate or slightly narrowed, 3-7-nerved, lateral nerves about 5 pairs, prominent, reticulations distinct; petiole .5-2 inches long, stout, not jointed to the blade; stipules .7-1 inch long, coriaceous. Figs .5-.7 inch diameter, supported by 3 rounded bracts, sessile, in axillary pairs, globose, puberulous, red when ripe. Male flowers crowded near the mouth of the receptacle; stamen one. *Banyan*. Vern. *barh*, *bor*.

Sub-Himalayan tract from the Indus eastwards; as a rule on precipitous rocky ground. Ascends to 3,000 feet. Usually small in the wild state and with the aerial roots poorly developed. Universally cultivated in the plains and reaches a very large size but the aerial roots often do not reach the ground. It is an epiphyte when young but is more often seen on walls, buildings and sides of wells than on trees. Easily grown from cuttings even large branches root readily. It is lopped by Muhammadans for feeding goats, buffaloes and camels. The leaves are used as plates. Figs ripen October—November on some trees, on other trees in April.

2. *FICUS RUMPHII*, Blume, *Bijdr.* (1825) p. 437.—A large deciduous glabrous tree; bark grey or yellowish-grey, smooth. Leaves 4-6 inches long, broadly ovate, acuminate, the acumen less than 1 inch long, about one-sixth the length of the blade, entire or margins subundulate, sub-coriaceous, base truncate but slightly narrowed towards the petiole, 3-5-(-7) nerved, lateral nerves 3-6 pairs, irregular, prominent only when young, upper surface shining, minutely tubercled when dry; petiole 2.5-3.5 inches long, channelled or flattened above, jointed to the blade; stipules .5-1 inch long, ovate-lanceolate. Figs .5 inch diameter, supported by 3 rounded bracts, sessile in pairs in the axils of the leaves or above the leaf-scars, globose, smooth, black when ripe. Male flowers few, near the mouth of the receptacle; stamen one. Vern. *palákh*.

Sub-Himalayan tract from the Chenab eastwards. Common in Kangra. Often epiphytic when young. Apt to be mistaken for *F. religiosa* which has more abruptly acuminate, more coriaceous and more shining leaves as well as a longer acumen. Also the figs are not depressed at the mouth. It is occasionally cultivated in the plains and frequently in Kangra.

3. *FICUS RELIGIOSA*, Linn. *Sp. Pl.* (1753) p. 1059.—A large glabrous tree, leafless or nearly so for a short time during the hot weather; bark grey, smooth when young, exfoliating in irregular scales when old. Leaves 4·5-7 by 3-5 inches, broadly ovate, rather abruptly narrowed into a linear-lanceolate acumen 1-3 inches long, about one-third the length of the blade or longer, entire or truncate, 5-7-nerved, lateral nerves 6-8 pairs, shining above and minutely lacunose, the lower surface minutely tubercled when dry; petiole 3-4 inches long, slender, jointed to the blade; stipules minute, ovate, acute. Figs ·5 inch diameter, supported by 3 rounded bracts, sessile in pairs in the axils of the lower leaves or above the leaf-scars, spheroidal, depressed at the mouth, smooth, dark-purple when ripe. Male flowers few, near the mouth of the receptacles or in many none; stamen one. *Pipal*. Vern. *pipal*.

Probably not indigenous but frequently planted in the plains and up to 4,000 feet in the outer Himalaya. Often self-sown in the Sub-Himalayan tract and sometimes seen as an epiphyte but more often on damp walls and buildings to which it does great damage if allowed to develop. The Pipal is sacred to Hindoos and hence is not cut or lopped by them but Muhammadans lop it freely for feeding goats and camels. Grows readily from cuttings. Figs ripen October—November on some trees, on other trees in April.

4. *FICUS INFECTORIA*, Roxb. *Hort. Beng.* (1814) p. 66.—A large deciduous tree, sometimes with a few aerial roots, all parts glabrous, bark grey smooth or scaly. Leaves 3·5-5 inches long, ovate or ovate-oblong rather abruptly shortly acuminate, entire or subundulate membranous, base rounded or sometimes slightly cordate occasionally narrowed and acute, 3-nerved, lateral nerves 5-7 pairs, not very prominent; petiole 1·5-2 inches long, channelled, sometimes indistinctly jointed to the blade; stipules about ·5 inch long, broadly ovate, acute. Figs (in the typical form) ·25 inch diameter, supported by 3 minute bracts, sessile in axillary pairs, globular, when ripe white flushed with red and dotted. Male flowers few near the mouth of the receptacles; stamen one. Vern. *palākh*.

Var. *LAMBERTIANA*, (sp. Miq.) Leaves coriaceous. Figs ·3-·4 inch diameter, on pubescent peduncles ·2-·3 inch long. Brandis, Ind. Trees, fig. 186.

Sub-Himalayan tract from the Indus eastwards. Salt Range, Trans-Indus. Var. *Lambertiana* in the Siwaliks but possibly not extending to the Punjab. Often planted. As a shade tree this is one of the best in the Punjab. Though not as large as the Pipal and Banyan it gives a much denser shade and for a garden possesses the advantage of shedding its leaves all in a few days and producing a fresh crop almost immediately afterwards. The young foliage is usually beautifully tinted.

5. *FIGUS OLAVATA*, Wall. *Cat.* (1828) No. 4495.—A shrub or small tree, young branches scabrid. Leaves 3-6 by 1-2 inches, sometimes larger, oblong-lanceolate or oblanceolate, abruptly caudate-acuminate, distinctly toothed in the upper half, rarely entire, both surfaces glabrous but rough, base narrowed, 3-nerved, lateral nerves 4-6 pairs, prominent beneath; petiole .1-.2 inch long, not jointed to the blade; stipules .3 inch long, lanceolate. Figs .5-.7 inch long, axillary, solitary, rarely paired, supported by minute bracts, ovoid or globose, yellow when ripe, usually strongly umbonate and verrucose; peduncles .1-.2 inch long. Male flowers mixed with the gall flowers; stamen one. Female flowers in smaller receptacles and on separate plants from the male. Brandis, *Ind. Trees*, fig. 187.

Outer Himalaya ascending to 7,000 feet. In shady ravines from Chamba eastwards. King in 'The Species of Ficus' (*Ann. Bot. Gard. Calc.*, I) gives the size of the fruits as .35 inch in globose and .5 inch in ovoid forms but in the specimens with ripe figs from the N.-W. Himalaya they are larger than this. The figure in Brandis, *Indian Trees*, is not typical and is likely to be misleading, the leaves are shown too broad and entire.

6. *FIGUS CUNIA*, Buch-Ham. ex Roxb. *Hort. Beng.* (1814) p. 66.—A small or medium-sized tree of irregular habit, bark dark-grey, young shoots pubescent. Leaves very variable in size, usually about 5-8 by 2-3 inches, sometimes 2 inches long or 12 inches or more, usually elliptic or oblong-lanceolate, acuminate, entire or serrate, scabrid on both surfaces or pubescent beneath, occasionally smooth above, base very unequal, one side with a 3-4-nerved rounded lobe, lateral nerves 9-14 pairs, prominent; petiole .2-.6 inch long, stout, scabrid, not jointed to the blade; stipules .7-1 inch long, linear-lanceolate. Figs in pairs or small clusters on long leafless scaly shoots from the larger branches or from the main stem near the base, shortly pedunculate, .4-.7 inch across, globose or pyriform, reddish-brown when ripe. Male flowers near the mouth of the receptacle; stamen one. Brandis, *Ind. Trees*, fig. 188. Vern. *Kandrol* (Ka.).

Sub-Himalayan tract from the Rawalpindi District eastwards. Common east of the Ravi. Usually on steep banks of ravines. Although so variable in foliage it is the easiest of the figs to recognize owing to the oblique base of the leaves.

7. *FIGUS HISPIDA*, Linn. *f. Suppl.* (1781) p. 442.—A shrub or small tree, twigs hollow, bark grey or greenish, smooth. Leaves opposite, 4-9 (-12) inches long, broadly ovate or obovate-oblong, acute or shortly acuminate, usually toothed, hispid-scabrid above, hispid-pubescent beneath, base cuneate rounded or slightly cordate; petiole .5-1.5 (-3.5) inches long stipules .5 inch long, ovate-lanceolate. Figs usually clustered on short or long leafless shoots from the main stem or larger

branches or on young plants axillary, .5-1 inch diameter, ovoid, hispid, supported by 3 small bracts and sometimes bearing small brown scales on the surface, yellow when ripe; peduncles .2-.6 inch long. Male flowers numerous, towards the mouth of the receptacles; stamen one. Vern. *dagurin* (Ka.).

Sub-Himalayan tract ascending to 3,500 feet in the outer Himalaya, from the Chenab eastwards. Common. Recently introduced in Changa Manga by canal water. A plant of rapid growth usually easily recognized by its opposite leaves but occasionally a specimen has the leaves alternate. Figs ripen in July.

8. *FIGUS SCANDENS*, Roxb. *Hort. Beng.* (1814) p. 65.—A climbing shrub, stem and branches often rooting. Leaves 2-4 by 1.2-2.5 inches, ovate or elliptic, acute, entire, coriaceous, glabrous and smooth above, roughish beneath from the prominent veins, base rounded or slightly narrowed, strongly 3-nerved, lateral nerves about 3 pairs impressed on the upper surface prominent beneath; petiole .3-.6 inch long; stipules .25 inch long, ovate, acuminate. Figs in axillary pairs or solitary by abortion, .3 inch diameter, supported by 3 ovate bracts, globose, not umbonate but with the umbilicus rather prominent, more or less scabrid, greenish-yellow when ripe; peduncles .3-.6 inch long, rather slender. Male flowers near the mouth of the receptacles; stamens 2. Female flowers on different plants to the male.

Sub-Himalayan tract from the Ravi eastwards. Not common. I have collected it once near Shahpur, Kangra, where it was climbing over a *Pinus longifolia*. This plant has been much confused with *F. gibbosa*, Blume, var. *parasitica*, a plant of Central India which has not been collected in Northern India. It may be distinguished by the leaves being hispid above and with the nerves rather prominent on the upper surface.

9. *FIGUS FOVEOLATA*, Wall. *Cat.* (1828) No. 4493, A-E.—A climbing shrub, creeping over trees and rocks and often rooting at the nodes, young shoots pubescent. Leaves on fruiting shoots 2-5 by .6-1.8 inches, ovate, elliptic or lanceolate, acute or acuminate, entire, glabrous above, pubescent or not beneath and closely reticulate, ultimate nerves stout raised leaving small pore-like depressions between them, base 3-nerved, rounded sub-cordate or slightly narrowed, lateral nerves 5-8 pairs, prominent below; leaves on sterile shoots usually under 2 inches long; petiole up to .5 inch long; stipules up to .5 inch long, ovate-lanceolate to linear. Figs axillary, solitary, .6 inch diameter, globular, umbonate, hairy, supported by 3 ovate often reflexed bracts, purple when ripe; peduncles .1-.3 inch long or occasionally up to .5 inch long. Male flowers mixed with the gall flowers; stamens 2 (3).

All along the Himalaya from the Indus eastwards. Also Trans-Indus. Extends to Kagen and Kunawar. Common in moist shady places usually

growing over rocks and ascending to 7,000 feet. A plant with a wide range and very variable but only the form described occurs in the Punjab.

10. *FIGUS PALMATA*, Forsk. *Fl. Ægypt-Arab.* (1775) p. 179.—A deciduous shrub or small tree; young parts tomentose or pubescent; bark grey, smooth. Leaves very variable, 1·5-5 inches long, orbicular or broadly ovate, crenate-dentate, often deeply lobed, scabrous above, usually tomentose beneath, apex rounded or acute, base broadly rounded or cordate, 3-nerved, lateral nerves 3-6 pairs; petiole 1-2 inches long; stipules ·3 inch long, ovate, acute. Figs ·5-1 inch diameter, supported by 3 or more acute deciduous basal bracts, axillary, solitary or in pairs, pyriform or globose, contracted towards the peduncle, purple when ripe; peduncle ·5-1 inch long. Male flowers numerous in the upper part of the receptacles; stamens 3-6. Collett, *Fl. Siml.*, fig. 148. Vern. *phagwāra*.

Plains of the Punjab usually in shady places and often as an undergrowth under trees. Hills ascending to 9,000 feet, on hot dry slopes. Occasionally reaches 10 feet in girth but no great height. Some of the cultivated figs probably belong to this species and others to *F. Carica*, Linn. (*q. v.*)

11. *FIGUS NEMORALIS*, Wall. *Cat.* (1828) No. 4517.—A small handsome tree; bark greyish-brown, nearly smooth, thin, all parts glabrous. Leaves 3-6 by 1-2 inches, lanceolate, ovate-lanceolate or elliptic-lanceolate, narrowed to a long acumens, entire, membranous, base usually cuneate, 3-nerved, lateral nerves 7-14 pairs, wide-spreading, reticulations dark-colored conspicuous on the pale lower surface; petiole ·5-1 inch long, reddish, not jointed to the blade; stipules ·4-6 inch long, lanceolate, convolute. Figs ·3 inch diameter, supported by 3 broad connate bracts, axillary, solitary or in pairs, when ripe usually below the leaves, reddish, sub-globose, umbilicus rather prominent; peduncle ·2 inch long. Male flowers near the mouth of the receptacles which also contain female and gall flowers; stamens 2-3.

Himalaya from Hazara eastwards 1,500-7,000 feet. Not common. The leaves are lopped for fodder. Figs ripen in April and October.

12. *FIGUS ROXBURGHII*, Wall. *Cat.* (1828) No. 4508.—A small or medium-sized tree with thick bole and spreading branches, bark yellowish-grey, nearly smooth; twigs hollow. Leaves 5-15 by 4-12 inches, broadly ovate or rounded, usually acute, entire or toothed, glabrous or nearly so above, softly pubescent beneath, base usually deeply cordate 5-7-nerved, lateral nerves 3-4 pairs joined by almost straight parallel transverse veins; petiole 1-8 inches long; stipules ·6-1 inch long, ovate-lanceolate. Figs in cluster on short thick leafless branches on the main stem often near the ground or on the larger branches, up to 3 inches across and 2 inches long, supported

by 3 rather larger ovate or triangular bracts, broadly top-shaped, apex depressed, umbilicus large, purple-orange when ripe; peduncle .7-1.7 inches long. Male flowers near the mouth of the receptacles; stamens 2, sometimes 3 or 1. Vern. *dhusi* (Rawalpindi), *trembal* (Ka.) *triamlu* (Ku.).

Outer Himalaya and Sub-Himalayan tract from the Indus eastwards ascending to 5,000 feet. Common in forests of *Pinus longifolia* where it is usually small and shrubby. Cultivated in Lahore but does not produce seed owing to the absence of its chalcid. Does not root easily from cuttings. The wood is harder than that of most species of *Ficus*. Fruits ripen March—April and again in August.

13. *FICUS GLOMERATA*, Roxb. Cor. Pl. II (1798) p. 18, t. 123.—A large deciduous tree; bark smooth, grey with a yellowish tinge. Leaves 4-5 inches long, ovate, elliptic-ovate or lanceolate, tapering to a bluntish point, entire, glabrous on both surfaces when mature, paler beneath and minutely tuberculate when dry, base blunt or rarely acute, 3-nerved, lateral nerves 4-6 pairs; petiole 1-2 inches long; stipules .6-.8 inch long, ovate-lanceolate. Figs on short leafless branches issuing from the stem and larger branches, rarely axillary, 1-1.5 inches diameter, pyriform or top-shaped, supported by 3 small triangular-ovate bracts, umbilicus depressed, red, orange or purple when ripe; peduncle .3-1 inch long. All three kinds of flowers in the same receptacle, the male rather numerous, near the mouth; stamens 2. Vern. *gulār*, *rumbal*.

Sub-Himalayan tract from the Rawalpindi District eastwards and in the neighboring plains. Salt Range. Occasionally planted in gardens and on roadsides but never ornamental. With the extension of irrigation this plant is extending into the plains, e.g., Changa Manga. The fruits are eaten by natives although they are usually swarming with insects. Figs ripen March—April and again in July—August, both crops on the same trees.

FICUS CARICA, Linn.—The cultivated fig. Resembles *F. palmata* very closely and is perhaps not specifically distinct. Supposed to be indigenous to Syria and Palestine. Cultivated in the plains and in Abbottabad. Fruits freely but the fruit requires to be well protected from birds. It is propagated by cuttings. Vern. *anjēr*.

FICUS ELASTICA, Roxb. — A large evergreen tree with the roots spreading superficially and exposed above the ground. Leaves 5-10 inches long, oblong or elliptic, with numerous fine parallel lateral nerves.

The India-rubber fig.—Indigenous to Assam. Suffers somewhat from frost in the Punjab. Propagated by layers or *goutis*.

FICUS MACROPHYLLA, Desf.—A tree much resembling *F. elastica* but with a more erect habit and without the superficial roots of that species. *The Moreton Bay Fig*.

Indigenous to Queensland and N. S. Wales. Cultivated in Lahore and Amritsar. There is a fine specimen in the Anarkali Garden, Lahore. This is the most ornamental species grown in the Punjab and deserves to be more widely cultivated. Propagated by imported seed. Young plants in dry districts require a situation not fully exposed to the sun.

FICUS RUBIGINOSA, Desf.—A large tree sending down aerial roots as the Banyan. Leaves 3-4 by 2-2.5 inches, elliptic. Figs .4 inch diameter,

globular. *F. australis*, Willd. *The Port Jackson Fig or Australian Banyan*.

Closely allied to *F. macrophylla* but with smaller leaves and fruit. Cultivated in Lahore and Saharanpur. Young plants require some protection from the sun.

FICUS RETUSA, Linn.—A large evergreen tree producing aerial roots which seldom reach the ground. Leaves 2-4 inches long, ovate or rhomboid-elliptic. Receptacles .3 inch diameter, globular, axillary, sessile, whitish.

Indigenous to East and South India. Often cultivated in the plains and very ornamental and shady. Suffers a good deal from frost in Lahore when young. Propagated by layers or *goutis*.

FICUS TSIELA, Roeb.—A tree closely resembling *F. infectoria* but with more indistinct nerves to the leaves, petiole not jointed to the blade and a peculiar greenish bark. Receptacles axillary, sessile, .5 inch diameter.

Indigenous to Central and Southern India. Cultivated in Lahore but suffers from frost.

FICUS PUMILA, Linn.—A climbing shrub with very dimorphous foliage. Figs 2 inches long, pyriform, on spreading branches with leaves 2-5-3 inches long. The leaves on sterile rooting branches 1 inch long or less.

Indigenous to China and Japan. Often grown in gardens in the plains. Used for covering walls.

13. STREBLUS, Lour.

(From the Greek *streblōs*, twisted; referring to the twisted branches. DISTRIB. Species 2; India and Malaya.)

STREBLUS ASPER, Lour. *Fl. Cochinch.* II (1790) p. 615.—A small rigid gnarled evergreen tree; bark light-grey or greenish with faint ridges, rough when old; juice milky; twigs hairy, scabrid. Leaves alternate, 1-4 inches long, rhomboid-elliptic, obovate or elliptic-oblong, acute or shortly abruptly acuminate, more or less sinuate or crenate, scabrid on both surfaces but especially beneath; lateral nerves 4-6 pairs; prominent beneath, joined by intra-marginal loops; petiole .05-.15 inch long; stipules rather longer than the petiole, obliquely lanceolate, acuminate. Flowers dioecious, axillary. Male flowers in globose pedunculate heads .3 inch diameter; peduncles 1-4 together, .3-.5 inch long. Perianth campanulate, sepals 4, pubescent outside, imbricate in bud. Stamens 4, inflexed in bud, anthers reniform. Female flowers solitary, inconspicuous, long peduncled; peduncles 1-4 together, .2-.5 inch long; bracts 2-3 below the perianth. Perianth closely embracing the ovary, sepals 4, enlarged in fruit. Ovary 1-celled; ovule pendulous; styles 2, very long, filiform, connate at the base. Fruit a 1-seeded berry, loosely enclosed by the enlarged sepals, yellow when ripe, .2 inch diameter.

Sub-Himalayan tract from the Ravi eastwards. In open scrubby jungle. Usually 20 feet high with a short bole 2-4 feet in girth. Has much the appearance of a *Ficus*. Wood white, moderately hard, it is not used. The fruit is edible and the leaves can be used as a substitute for sand-paper. The bark is very fibrous. It is a good hedge plant as it is densely branched but it is eaten down by goats. Flowers: March—April.

MACLURA AURANTIACA, Nutt.—A deciduous tree 60 feet high, 6-9 feet in girth; bark brown, deeply longitudinally fissured; twigs often armed with straight axillary thorns. Leaves alternate, 3-5 by 2-3 inches, ovate or oblong-lanceolate, acuminate and apiculate at the tip, entire, base rounded, subcordate or narrowed; petiole 7-15 inches long; stipules minute, triangular. Flowers dioecious, greenish, minute. Male flowers long pedicelled, in short or ultimately elongated racemes 1-1.5 inches long; peduncles slender, from the axils of the leaves, crowded on dwarf shoots; calyx 4-lobed to the middle, hairy outside; lobes ovate, imbricate; corolla 0; stamens 4, inflexed in bud. Female flowers sessile, in dense axillary pedunculate heads on the shoots of the current year, heads 7-1 inch diameter; calyx 4-lobed to the base: lobes oblong, thick, concave, hairy at the tips, the two outer broader than the inner; ovary 1-celled; ovule pendulous; style long, filiform, hairy. Fruit yellowish-green, globose, mamillate, 4-5 inches diameter, composed of the succulent confluent perianths. *Osage Orange*.

Indigenous to the Southern United States. The female tree has long been cultivated in the Punjab and grows very well. It is very hardy against frost and drought but requires a deep soil. In habit and requirements this tree resembles *Morus alba*. The timber is very hard, heavy, strong, flexible and durable, the sapwood is narrow, the heartwood is orange-colored darkening on exposure. The tree grows readily from cuttings and also produces root-suckers. The leaves turn yellow in autumn before falling. Cultivated in Lahore, Abbottabad, Khushalgarh, etc.

ARTOCARPUS, Forst.—Trees with milky juice. Leaves alternate. Flowers monoecious, densely crowded on globose or oblong, solitary, unisexual receptacles, often mixed with peltate bracts. Male flowers; perianth 2-4-lobed or partite; lobes obtuse, concave, valvate or slightly imbricate; stamen 1, erect in bud. Female flowers; perianths tubular, connate and confluent below with the receptacle, mouth minute; ovary 1-celled; style central or lateral; stigma usually entire. Fruit a much enlarged fleshy receptacle, clothed with the greatly accrescent fleshy perianths and carpels which have hardened, spinescent, truncate, pyramidal or flat apices.

ARTOCARPUS LAKOOCHA, Roxb.—A large deciduous tree. Leaves 4-12 by 2-6 inches, coriaceous, oblong, elliptic or ovate, entire, cuspidate, pubescent beneath; petiole 5-1 inch long; stipules 5 inch long, lanceolate, pubescent. Flower-heads axillary, pedunculate, globose, 5-1 inch diameter. Fruit 2-8 inches diameter, lobulate, smooth, velvety, yellow, edible. Vern. *Daku*.

Indigenous east of Kumaon and to S. India. Cultivated in the Punjab as far west as Lahore. Common round Delhi. Both this and the following have much the appearance of a *Ficus*, but the flowers are on the outside instead of on the inside of the receptacles. A very handsome tree when well grown but rather tender. It gets injured by every severe frost in Lahore.

ARTOCARPUS INTEGRIFOLIA, Linn. f.—A large evergreen tree. Leaves 4-8 inches long, elliptic or obovate, entire (often lobed in young trees), dark-green and shining above, glabrous; petiole 5-1 inch long, not stout; stipules large, spathaceous, caducous. Flowers mostly appearing on short branches on the stem and large branches. Male flower-heads cylindric, 2-6 by 5-1 inch. Fruit 12-30 by 6-12 inches, tubercled, brown. *Jack-fruit*. Vern. *Kuthal*.

Cultivated occasionally in the East Punjab as far west as Lahore. Rather more tender than *A. Lakoocha*.

PLECOSPERMUM SPINOSUM, Trecul.—The Flora of Brit. Ind., V, p. 491 gives "Salt Range 3,000 feet" based on J. L. Stewart's remark in Brandis For. Fl., p. 401. I have seen no specimens from the Punjab or even from the U. P., and I think there is little claim for this being considered a native of the Punjab.

The following herbs belonging to this family are common and conspicuous :—

CANNABIS SATIVA, *Linn.*—A tall erect annual. Leaves palmately 1-11-partite, lobes linear-lanceolate, long-acuminate, serrate, 2-3 inches long. Flowers pale-greenish, dioecious. Fruit an achene enclosed in the persistent perianth. *Hemp*. Vern. *Bháng*.

Abundant in waste places along roadsides, etc. Springs up during the rains and reaches 10 feet or more in height. The bast fibres are used for making rope. The intoxicating drugs *bháng*, *ganja* and *charas* are prepared from resinous exudations of the stem, young leaves and flowers. *Bháng* consists of the dried leaves and flowering shoots. It is mixed with water and used as a beverage. *Ganja* consists of the dried flowering tops of cultivated female plants which become coated with a resinous substance in consequence of being deprived of the opportunity of setting seed by the early removal of the male plants. *Charas* is the resinous substance which appears spontaneously on all parts of the hemp plant when cultivated in cold and dry countries. It is used for smoking and as it contains a larger proportion of the active principle it is more narcotic than either *ganja* or *bháng*.

GIRARDINIA HETEROPHYLLA, *Decne.*—A coarse erect herb 4-6 feet high, covered with large stinging hairs. Leaves 4-12 inches long, variously lobed, coarsely serrate. Collett, Fl. Siml., fig. 149.

This is the largest and one of the commonest of the *Stinging Nettles*. It is usually found in the hills at about 5-7,000 feet though often at much lower elevations. The bast fibres are used for making ropes.

LXXXIV. PLATANACEÆ.

A family containing one genus and 2-4 species one of which is frequently cultivated.

PLATANUS ORIENTALIS, *Linn.*—A large deciduous tree, bark of young trees always, of old trees frequently, peeling off in large thin flakes leaving the stem smooth and pale, often nearly white, young parts tomentose. Leaves alternate, 5-8 inches long, often broader than long, deeply 5-7-lobed (rarely 3-lobed), the lobes much longer than broad, glabrous when mature, 3-5 strong palmate nerves starting usually a little above the base; petiole 1.5-2.5 inches long, the base with a conical hollow which fits over the bud; stipules large, connate, amplexicaul, silky, caducous. Flowers monœcious, slightly perigynous, densely crowded, in unisexual globose heads, heads 2-5 on a long terminal pendulous peduncle. Male flowers 3-4-merous; sepals hairy, petals glabrous, both minute and scale-like often more or less confluent; stamens as many as sepals, anthers almost sessile consisting of two long parallel cells adnate to a connective which is peltately expanded and hairy at the tip. Female flowers; perianth of the male, carpels as many as sepals, free, hairy at the base passing gradually into the styles; ovule 1, rarely 2 in each carpel, pendulous; style hooked at the tip; stigma a long strip running down the style. Fruit a globose head 1-3 inches diameter, consisting of numerous 1-seeded achenes densely clothed at the base with long fine hairs, narrowed gradually into the persistent styles. *Plane*. Vern. *Chinár*.

Found growing spontaneously from S. E. Europe to the Indus. Planted in the Punjab rather frequently in Hazara becoming scarce towards the east. It grows well in the plains with sufficient moisture and there are good specimens in Lahore and Changa Manga but it is said to do badly in Saharanpur. It is quite frost hardy and is grown up to 8,300 feet in Kashmir. It is usually grown from cuttings which root readily even when thick stakes or posts are used. Seed germinates freely but requires to be very lightly covered and given abundant moisture. The tree does best near springs or streams and in time reaches a very large size. Stewart mentions one of 28 feet girth in

Kashmir. The tree being cultivated for ornament and shade is not cut. The wood is white tinged with yellow or red with numerous broad medullary rays. The tree cultivated in Europe and known as the *London plane*, *P. acerifolia*, Willd., is supposed to be a hybrid between *P. orientalis* and *P. occidentalis*, it has also been considered by some to be a variety of one or other of these species. *P. acerifolia* differs from *P. orientalis* mainly in the leaves being often 3-lobed and the middle lobe being broader than long. Flowers with the young leaves in April.

LXXXV. JUGLANDACEÆ.

Trees, often strongly aromatic. Leaves alternate, pinnate, stipules 0. Flowers unisexual, monœcious. Male flowers in pendulous catkins-like spikes, anthers 2 or more, nearly sessile, inserted on the upper surface of a bract which bears on its edge 2-6 membranous perianth-lobes. Female flowers in many- or few-flowered spikes, bracteate; perianth adnate to the 1-celled ovary, limb minutely 4-toothed; petals 0 or minute; ovule 1 erect; style short, 2-fid, the arms stigmatose and papillose within. Fruit a drupe or nut. **DISTRIB.** A small family; chiefly North Temperate regions.

Leaves imparipinnate, aromatic; female flowers
1-3 in a terminal spike; fruit large, pericarp
fleshy 1. *Juglans*.

Leaves usually paripinnate; female flowers in long
pendulous lateral spikes; fruit small, adnate to
the enlarged 3-lobed bract which forms a wing... 2. *Engelhardtia*.

1. JUGLANS, Linn. (*The Walnut*).

(The Latin name used by Pliny, derived from *Jovis glans*, the nut of Jupiter. **DISTRIB.** Species 10; one in Tropical America the rest temperate.)

JUGLANS REGIA, Linn. *Sp. Pl.* (1753) p. 997.—A large deciduous tree, leaves and bark aromatic; bark on old stems marked by parallel vertical furrows, grey; young shoots tomentose. Leaves 6-15 inches long, imparipinnate, more or less tomentose when quite young. Leaflets 5-9 (-13) the terminal largest, 3-8 by 1·5-4 inches, variable, from elliptic to oblong-lanceolate, acute or acuminate, usually entire, glabrous or pubescent along the nerves beneath, the lateral leaflets opposite or subopposite, sessile or subsessile. Male spikes lateral on the shoots of the previous year, 2-5 inches long, often 2 superposed to one leaf-scar; bracts stipitate; stamens 10-20, apiculate. Female flowers 1-3, sessile, in a short terminal spike; calyx-tube ·25 inch long, ovoid, densely tomentose, limb minute, obscurely 4-toothed; petals green, linear-lanceolate, usually minute. Fruit a drupe, 2 inches long, ellipsoid, green, pericarp (composed in part of the calyx-tube) leathery, aromatic, nut externally distinctly 2-valved corresponding to the 2 carpels of which the ovary is composed, rugose, internally incompletely divided by 2 coriaceous dissepiments one separating the two cotyledons the other dividing them into 2 lobes. *Walnut*. Vern. *akrôt*, *akhor*, *khor*.

Himalaya usually 5-11,000 feet in moist ravines and on patches of fairly level ground with deep soil. Cultivated from 3,500 feet to 11,000 feet especially in the inner hills of Kagan; Chamba; Kulu and Bashahr. According to L. A. Dode, *Contribution à l'Etude du Genre Juglans* in Bull. Soc. Dendrolog. de France, Dec. 1906, *Juglans regia* does not occur in the West Himalaya but is there replaced by *J. fallax*, Dode, l. c. p. 89 and by *J. kamaonia*, Dode, l. c. p. 86. He further suggests that the thin-shelled *kaghazi* walnut is a third species *J. Duclouxiana*, Dode, l. c. p. 81. The differences between these so-called species are based on indefinite and variable characters, and as far as I have seen are not accompanied by differences in the trees as they grow. In *J. fallax* the leaflets are mostly ovate, acute, entire, with a sub-cordate base. Trans-Indus specimens answer this description. In *J. kamaonia* the leaflets are mostly ovate-lanceolate or oblong-lanceolate, acuminate, often denticulate towards the apex, base narrowed, somewhat oblique and rounded in the lateral leaflets. Specimens from the U. P. and Kunawar belong here. Chamba and Kashmir specimens are intermediate between *J. fallax* and *kamaonia* as regards the shape of the leaflets.

The timber of the walnut is moderately hard, even-grained, the sapwood broad greyish-white, heartwood brown with darker streaks. It is used in the hills for furniture and for carving, the Kashmir carved tables, &c., being usually made of walnut. Being the best wood for gun-stocks there is always a demand for it but mature trees are too scattered and inaccessible to be exported economically. Wild trees often reach a large size. Stewart notes one of 28 feet girth in Kulu and one of 22 feet in Chamba and it often reaches 80-100 feet in height. Cultivated trees are however usually short in bole. Burrs are frequently found on the walnut and when of large size and good color they are extremely valuable. The value however depends entirely on the quality which can only be judged by an expert. The price in Europe ranges between £12 and £120 per ton. The burrs are cut into veneer and used for furniture. The walnut is often cultivated for its fruit the best being the thin-shelled *kaghazi* variety. The wild tree is of little value for its fruit and is frequently lopped for fodder and is sometimes cultivated for lopping. Flowers: February—April. Fruit: July—September.

2. ENGELHARDTIA, Lesch.

(A commemorative name. DISTRIB. Species 9; India, Malaya and China.)

ENGELHARDTIA COLEBROOKEANA, Lindl. in Wall. Pl. As. Rar. III (1832) p. 4, tab. 208.—A small deciduous tree, young shoots tomentose. Leaves usually paripinnate by the abortion of the terminal leaflet, rachis about 3-7 inches long. Leaflets 3-5 pairs, opposite or subopposite, 2-8 inches long, elliptic or elliptic-oblong, usually obtuse, entire, base unequal, subcoriaceous, glabrescent above tomentose or glabrous beneath and dotted with very minute (almost microscopic) yellow scales, base unequal-sided; petiolules 0-3 inch long. Male spikes 3-5 inches long, solitary or 3-5 together, arranged racemously on a short rachis 1 inch long or less; perianth of 4-5 oblong scales attached to a stipitate more or less 3-lobed bract; anthers 4-12, sessile, hispid. Female spikes 2-6 inches long, pedunculate, solitary or at the end of the raceme of male spikes; bracts with 3 large unequal lobes, cup-shaped below and enclosing the base of the calyx; calyx adnate to the ovary, glabrous or tomentose, the limb 4-toothed; petals 0; ovary 1-celled; stigmas 2, large, densely papillose. Fruiting spikes

4-10 inches long including the peduncle. Fruit a globose coriaceous 1-seeded nut .2 inch diameter, adnate to the greatly enlarged bract which is reticulate, densely tomentose at the base and has 3 oblong-spathulate lobes, each with a distinct penniveined midrib, the longest 1-1.2 inches long, the lateral lobes half as long. Vern. *samma*.

Sub-Himalayan tract and low valleys of the Himalaya ascending to 5,000 feet from the Rawalpindi District eastwards. Locally quite common and gregarious and then perhaps not again found anywhere in the neighborhood. It is found in a small patch near Panjar, District Rawalpindi; common near Pundwar, Kangra, and has been collected in Hoshiarpur, Chamba and Bashahr but as yet not in the Simla Division. The wood is grey with a reddish tinge moderately hard, it is not used. The growth is fast. Flowers: March—May.

LXXXVI. MYRICACEÆ.

Trees or shrubs, aromatic and glandular. Leaves alternate; stipules 0. Flowers unisexual, in cylindric bracteate catkin-like spikes, the male spikes sometimes fascicled or panicle, the female always solitary, occasionally a few female flowers at the top of the male spikes. Perianth 0. Male flowers often surrounded by 2 or more bracts; stamens 2-16, usually 4; filaments short, free or connate; anthers erect, 2-celled. Female flowers 2-4-bracteate; ovary 1-celled, composed of 2 carpels; ovule one, erect; style 2-fid, the arms stigmatose on the inner side. Fruit a small ovoid or globose drupe, succulent, resinous or waxy, endocarp hard. **DISTRIB.** The following is the only genus.

MYRICA, Linn.

(From *Murike*, the Greek name for the tamarisk, used by Homer. **DISTRIB.** Species 35; throughout the world excluding Australia.)

MYRICA NAGI, *Thunb. Fl. Jap.* (1784) p. 76.—A small evergreen tree, bark rough brownish-grey, young shoots petioles and inflorescence tomentose. Leaves crowded towards the ends of the branches, 3-5 by 1-2 inches, narrowly oblong or oblong-lanceolate, narrowed at both ends, entire, glabrous when mature, coriaceous, dotted beneath with minute resinous dots; petiole .3-.6 inch long. Male spikes .3 inch long, arranged racemously on a common axillary stalk 1-3 inches long; bracts orbicular, often with 2-3 smaller lateral ones; stamens 3-6. Female spikes axillary, erect, .5-1 inch long. Drupe .4 inch long, ellipsoid, scaly, flesh red, composed of spindle-shaped fleshy fibres radiating from the rugose stone. Collett, *Fl. Siml.*, fig. 151. Vern. *Kaiphāl*.

Outer Himalaya from the Ravi eastwards 3-6,000 feet. Not common. The fruit is edible and the bark is used as an aromatic stimulant and externally as a plaster for rheumatism. The wood is hard and heavy, it is not used. Flowers: August—September.

LXXXVII. CASUARINACEÆ.

A family containing one genus, two species are cultivated in the Punjab. They are easily recognized by their slender leafless green twigs ribbed and jointed like a horsetail.

CASUARINA, *Forst.*—Leafless trees or shrubs; branchlets cylindric, grooved, jointed, internodes terminating in a short sheath of connate scales (leaves). Flowers unisexual, monœcious or diœcious; males in terminal spikes formed of superposed shortly toothed cups (whorls of bracts); females in ovoid or globose heads, bracteate and 2-bracteolate. Male flowers; bracteoles 2, lateral, persistent; perianth of 2 hoodshaped segments breaking off at their narrow bases when the solitary stamen expands; filament inflexed in bud; anther large, 2-celled. Female flowers; perianth 0; ovary 1-celled, composed of 2 carpels; ovules 1-2, ascending; style with 2 filiform stigmas. Fruits of small seed-like compressed nuts produced at the apex into a membranous wing, contained in a woody cone composed of the enlarged bracts and bracteoles, each fruit being contained in a depression closed till ripe by 2 valves. *DISTRIB.* Species about 32; mostly Australian, several in the East Indies, one extending to Malaya and Burma.

A.—Sheath at the apex of the internodes 6-8- usually 7-toothed.

CASUARINA EQUISETIFOLIA, *Forst.*—A large erect tree, bark brown, rough but not deeply fissured. Branchlets very slender, .02 inch diameter (when dry). *Beefwood*.

Indigenous on the seacoast of N. S. W. and Queensland extending to Chittagong and Burma. Often grown in gardens in the plains and does well. I have never seen it injured by frost in Lahore. The growth is fast. The timber is very hard and gives an excellent firewood. The tree is often mistaken for a tamarisk but it has a more elegant and feathery habit than *T. articulata*, the only species which approaches it in size. Does badly in the Sub-Himalayan tract as a rule but not if given a warm dry situation such as a roadside. Flowers: March.

B.—Sheath at the apex of the internodes 10-13-toothed.

CASUARINA MONTANA, *Jungh. var. VALIDIOR*, *Miq.*—An erect tree smaller than *C. equisetifolia* and with darker rougher more fissured bark. Branchlets about .05 inch diameter (when dry). *C. Junghuhiana*, *Miq.*

Indigenous to the mountains of Java from 6-10,000 feet forming extensive forests. Cultivated in Lahore, Amritsar and Kapurthala. It does well and has rather the appearance of a conifer. It also produces root-suckers rather freely which I have never seen in *C. equisetifolia*. The growth is fairly fast. Has been grown for many years in India as *C. stricta*. Flowers: March.

LXXXVIII. CUPULIFERÆ.

Trees, rarely shrubs. Leaves alternate, simple, stipules deciduous. Flowers monœcious. Male flowers in catkin-like spikes, rarely in heads; perianth simple, membranous or 0; stamens 2-many, filaments free; anthers 2-celled; pistillode rudimentary and hairy or 0. Female flowers in spikes, heads or solitary; perianth adnate to the ovary or 0, limb when present usually small, annular or dentate; ovary inferior or

naked, after fertilization usually more or less perfectly 2-3-celled; ovules solitary or two, collateral, pendulous from, or from near the apex of the cell; styles as many as ovary-cells, short or elongate, connate at the base. Fruit a nut, included within. or in the axil of, often greatly enlarged bracts, seed usually one by abortion. **DISTRIB.** A family of great forest importance in north temperate regions, a few species tropical and in the southern hemisphere.

Leaves deciduous, membranous; male catkins cylindric, dense; fruit various.

Bracts of the fruiting spike forming a woody cone ... 1. *Alnus*.

Bracts of the fruiting spike not forming a cone.

Bracts not greatly enlarged in fruit, nut with two small membranous wings ... 2. *Betula*.

Bracts greatly enlarged in fruit.

Nut small adnate to the base of a large reticulate wing-like bract ... 3. *Carpinus*.

Nut rather large enclosed in a sheathing bracteole ... 4. *Corylus*.

Leaves evergreen; male catkin slender, interrupted; fruit a nut (acorn) seated on a cup composed of hardened bracteoles ... 5. *Quercus*.

1. **ALNUS**, Linn. (*The Alders*.)

(The Latin name of the Alder.)

Deciduous trees. Leaves alternate, penniveined, often with tufts of hairs in the axils of the nerves. Flowers monœcious. Male flowers in pendulous catkins; bracts 3-flowered, with usually 4 bracteoles adnate to each bract; sepals 4; stamens 4, opposite to the sepals, anthers subsessile. Female flowers in short erect spikes; ovaries 2 in the axil of each bract, each with 2 bracteoles, 2-celled; ovules 1 in each cell; styles 2, the tips stigmatose. Fruiting spike a small woody cone composed of the persistent bracts between which are the small 1-seeded nuts; nuts narrowly winged or margined. **DISTRIB.** Species about 30; North temperate region and the Andes.

Leaves narrowed from about the middle to the apex; lateral nerves or their branches running to the margin which is usually sinuately toothed; anther-cells nearly distinct; female flowers solitary, axillary; nut with a narrow coriaceous margin ... 1. *A. nitida*.

Leaves rounded, acute or abruptly very shortly acuminate; lateral nerves anastomosing within the margin which is usually entire; anther-cells connate; female flowers in axillary racemes of 4-8; nut with a membranous wing ... 2. *A. nepalensis*.

1. *ALNUS NITIDA*, *Endl. Gen. Pl. Suppl.* IV ii (1847) p. 20.—A large tree, bark dark-grey, smooth, shining when young, black and very rough on old stems; young twigs usually glabrous, dotted with minute drops of resin. Leaves variable, 2-8 by 1-5 inches, ovate or sometimes lanceolate or elliptic, narrowed from about the middle to the apex, base rounded or cuneate, rarely truncate, margin usually sinuately toothed, glabrous or nearly so except for tufts of hairs in the axils of the nerves, lower surface with minute resinous dots; lateral nerves 6-12 pairs, running to the margin; petiole 5-2 inches long. Male catkins 5-10 inches long, about 4-5 in a terminal raceme. Anther-cells nearly distinct. Female spikes about 3 inch long, solitary or occasionally in pairs in the leaf-axils. Cones usually 1-1.8 inches long, apparently in racemes owing to the fall of the leaves. Nut with a narrow coriaceous margin. Vern. *Kosh.* (Ka.), *sharol* (Haz.)

Himalaya 3,000-9,000 feet from the Jumna valley to Chitral, mainly on banks and islands of hill streams and in moist places in the inner valleys. Common in Bashahr along the Pabur River and in Kunawar. Also common in Hazara, in Kagan and Siran valleys. Often planted for shade in Hazara and reaches a very large size, 10-12 feet in girth with a height of 90-100 feet is not infrequent. Wood reddish-white, soft, even-grained, it is not used. This alder is an excellent road-side tree in moist places in the hills but it is seldom used for this purpose. Stewart states that it follows the rivers down into the plains but I have never seen this. The bark is said to be used for dyeing and tanning. Flowers: August—October.

ALNUS NEPALENSIS, *D. Don, Prodr. Fl. Nep.* (1825) p. 58.—A deciduous tree; young twigs usually pubescent. Leaves 4-6 by 2-4 inches, elliptic, apex rounded, acute or abruptly very shortly acuminate, entire or undulate, rarely serrulate, base rounded or narrowed, pubescent along the nerves beneath when young, usually glaucescent and dotted with minute resinous dots; lateral nerves 6-15 pairs, curving upwards and anastomosing within the margin; petiole 4-7 inch long. Male catkins 5-10 inches long, in large terminal panicles. Anther-cells connate. Female spikes 3 inch long, in axillary racemes of 5-6, rarely solitary. Cones 5-8 inch long, apparently in panicles owing to the fall of the leaves. Nut with a narrow membranous wing.

Himalaya from the Sutlej (Ravi?) to Assam 3,000-8,000 feet. This tree seems to have been confused with *A. nitida*. Of the color of the bark, Brandis says "purplish or yellowish silvery, somewhat resembling the bark of birch." I have seen no alder with a bark answering this description. It appears to be a forest tree and not a tree of river banks and moist places like *A. nitida*. The leaves are quite different in the two species in shape, venation and length of petiole and in *A. nepalensis* they are papillose beneath but not in *A. nitida* but to see this a strong lense or microscope is necessary. Wood as for *A. nitida*. Flowers: October—November.

2. *BETULA*, Linn. (The *Birches*.)

(The Latin name of the common birch of Europe, *B. alba*, Linn.)

Deciduous shrubs or trees; bark white or reddish brown, peeling off in thin papery strips at least in young stems. Leaves serrate, ovate, acute or acuminate. Flowers monœcious. Male flowers in pendulous catkins; bracts peltate with usually 3 bibracteolate flowers; sepals 2-4; stamens 2, filaments forked, separating the anther-cells. Female flowers in erect or pendulous spikes; bracts imbricate, bracteoles 2, adnate to the bract which thus appears 3-lobed; perianth 0; ovary 2-celled, compressed, usually 3 ovaries in the axil of each 3-lobed bract; ovules 1 in each cell; styles 2, slender; stigmas terminal. Fruiting spike of deciduous 3-lobed scales and winged or margined nuts. **DISTRIB.** Species about 33; North Temperate regions.

Bark white; when young petioles silky and leaves sticky, the former soon becoming glabrous; female spikes solitary; fruiting bracts deeply 3-lobed, broader than the fruit, the wings of which are narrower than the nucleus ... 1. *B. utilis*.

Bark greyish-brown; when young petioles and midrib tomentose; female spikes usually in clusters of 2-3; fruiting bracts with 2 small lobes or teeth, narrower than the fruit, the wings of which are broader than the nucleus 2. *B. alnoides*.

1. **BETULA UTILIS**, *D. Don, Prodr. Fl. Nep.* (1825) p. 58.—A small deciduous tree or shrub; bark white with conspicuous long horizontal lenticles the inner layers pink, peeling off in large papery layers; twigs dotted with yellow resinous drops; young shoots, petioles and leaves silky soon becoming glabrous. Leaves 2-4 inches long, ovate, acute, sharply irregularly serrate, base broadly cuneate or rounded, rarely subcordate, sticky when young with yellow resinous scales; petiole 4-8 inch long. Male catkins 2-3 inches long, collected at the tips of long shoots. Female spikes about 1 inch long, solitary, erect, terminating dwarf shoots. Fruiting spikes not exceeding 1.5 inches long; bracts deeply 3-lobed, lobes linear-oblong; fruit narrower than the bracts, the wings narrower than the nut. Brandis, Ind. Trees, fig. 191. Vern. *Bhuj, burj, bhujpattra*.

Himalaya mainly between 10,000 and 14,000 feet, Trans-Indus to Sikkim extending far into the inner valleys and there common, occasionally scattered individuals are found as low as 7,000 feet. Usually gregarious towards the limit of tree growth associated with *Pyrus foliolosa* and *Rhododendron campanulatum*. Often only found on rocky steep ground having evidently been driven out of the more gentle slopes by excessive grazing as it is found on such ground in inaccessible and unfrequented places. It is much lopped for fodder and cut for firewood by graziers. The wood is pinkish-white, tough, evengrained. The growth is slow and reproduction usually wanting owing to grazing. The outer bark is peeled off in large strips and used for umbrellas, roofing houses, packing and in place of paper as a writing material. Flowers with the young leaves in May.

2. *BETULA ALNOIDES*, *Buch-Ham. in D. Don, Prodr. Fl. Nep.* (1825) p. 58.—A medium-sized deciduous tree; bark dark-grey or brownish, marked with long horizontal lenticels; twigs not resinous, tomentose when young, one-year old still pubescent; petioles midrib and main nerves beneath tomentose, ultimately becoming glabrous. Leaves 3-5 inches long, ovate or ovate-lanceolate, acuminate, unequally doubly or trebly usually cuspidately serrate, base rounded or subcordate, when mature glabrous except along the nerves beneath, dotted on the under surface with minute inconspicuous resinous scales; petiole .3-.6 inch long, tomentose when young, afterwards pubescent. Male catkins 2-4 inches long, at the tips of long shoots. Female spikes about 2 inches long, 2-3 together, rarely solitary, pendulous, terminating dwarf shoots. Fruiting spikes often 3 inches long; bracts with one oblong lobe and two small lateral lobes or teeth; fruit broader than the bracts, the wings broader than the nut. Vern. *Sheori* (Sutlej), *Shagru* (Ku.).

Himalaya 6,000-9,000 feet from the Ravi eastwards. Not uncommon in Bashahr and Simla. A tree of moist ravines, not gregarious. Wood white, evengrained, not hard, it is not used. The bark does not come off in large thin sheets as in *B. utilis* and is not white so the two cannot be confused in the field. Flowers: April (apparently also at other time).

3. *CARPINUS*, Linn. (*The Hornbeams*.)

(The Latin name of the common hornbeam of Europe, *C. Betulus*, Linn.)

Deciduous trees with smooth bark and fluted stems. Leaves penniveined, serrate. Flowers monœcious. Male flowers in lateral pendulous catkins; bracts ovate; bracteoles 0; perianth 0; stamens 3-4 on a hairy torus adnate to the bract, filaments 2-fid separating the anther-cells. Female flowers in drooping terminal spikes; bracts foliaceous; bracteoles 2; perianth-limb minute, superior, toothed; ovary 2-celled; ovules 1 in each cell; style-arms 2, long, stigmatose on the inner face. Nut one-seeded, 6-12-ribbed, enclosed in the base of the enlarged foliaceous bract and bracteoles which form a reticulate wing to the fruit. **DISTRIB.** Species 21; North Temperate Regions, most numerous in China. Vern. *Himri* (Ku).

Shoots and petioles glabrous; leaves glabrous except when unfolding, caudate-acuminate, biserrate; fruiting bract broadest near the base, usually 3-lobed ... 1. *C. viminea*.

Shoots and petioles tomentose; leaves silky on the nerves beneath, acuminate, subequally serrate; fruiting bract broadest in the middle, base not lobed ... 2. *C. faginea*.

1. *CARPINUS VIMINEA*, *Lindl. in Wall. Pl. As. Rar.* II (1831) p. 4, tab. 106.—A medium-sized tree; young shoots

glabrous, one year old dotted with white lenticles. Leaves 3-5 by 1-2 inches, ovate-lanceolate, sometimes ovate or lanceolate, caudate-acuminate, sharply biserrate except the tail which is simply serrate, glabrous except when unfolding, lateral nerves conspicuous, prominent beneath, parallel not close; petiole .3-.6 inch long, slender, glabrous or nearly so. Male catkins 1-2 inches long; rachis and anther-cells silky. Female catkins less than 1 inch long, silky. Fruiting spikes 3 inches long; bract lanceolate, unequal-sided, the narrower side entire or subentire, the broader coarsely toothed, usually with two small lobes one on each side near the base which bring the greatest width of the bract well below the middle. Nut .15 inch long, glandular.

Himalaya 6-9,000 feet from Chamba eastwards. Mainly in the outer hills of Kangra and Simla but also in the inner parts, *e. g.*, Bashahr. Wood white, hard, it is not used. The growth is rather slow and regeneration not good except from coppice. Flowers: March—April.

2. *CARPINUS FAGINEA*, Lindl. in Wall. *Pl. As. Rar.* II (1831) p. 5.—A medium-sized tree; young shoots tomentose, one year old still distinctly hairy. Leaves 2.5-5 by 1-1.8 inches, ovate-oblong, acuminate, sharply serrate, the teeth nearly equal, very silky beneath when young, persistently hairy on the nerves, lateral nerves conspicuous, prominent beneath, rather close and parallel; petiole .1-.2 inch long, silky-tomentose. Female catkins densely silky; fruiting bract unequal-sided, one side semi-elliptic or ovate toothed, the other narrow, entire, the greatest width at or near the middle. Otherwise as for *C. viminea*.

Himalaya 6-8,000 feet from Jammu eastwards. Apparently replaces *C. viminea* in the inner hills. The Bashahr specimens are all *C. faginea* but Lace's No. 920 includes a piece of *C. viminea* so they are evidently sometimes found growing together. The short silky petiole is sufficient to distinguish this species from *C. viminea*. Flowers: March—April.

4. *CORYLUS*, Linn. (*The Hazels*.)

(The classical name for the Hazel from *korys*, a helmet; in allusion to the involucre of the nut. *DISTRIB.* Species 10; North temperate region.)

CORYLUS COLURNA, Linn. *Sp. Pl.* (1753) p. 999.—A small or medium-sized deciduous tree, bark dark-grey, thin. Leaves alternate, 3-8 by 2.5-5 inches, ovate or obovate, acuminate, irregularly and sharply lobulate and toothed, base cordate, thin, membranous, glabrous when mature except in the axils of the nerves on the lower surface; lateral nerves 10-12 pairs, the lowest pair basal; petiole 1-1.5 inches long, pubescent and with gland-tipped hairs. Flowers monœcious, appearing before the leaves. Male flowers solitary in the axils of obovate acute bracts, arranged in drooping catkins 2-3 inches long, the catkins in short racemes of about 4-6; bracteoles 2, adnate

to the bract; perianth 0; stamens usually 8; filaments short, more or less connate, anthers 1-celled. Female flowers very minute, in small sessile bud-like spikes composed of numerous imbricate bracts, the flowers in pairs in the axils of a few of the uppermost bracts; bracteole solitary, 3-partite; perianth-tube adnate to the ovary, limb annular toothed; ovary 2-celled; ovules one in each cell; style-arms two, linear, red. Fruit a 1-seeded nut .5-.7 inch long, sheathed by the much enlarged lobed and toothed glandular-hairy bracteole and supported by large lacinate bracts, the nuts usually in clusters. Vern. *Thangoli, Thangi* (Pangi), *Sharoli* (Bash., Ku.), *Urni* (Kagan).

Himalaya 5,000-10,000 feet from Kumaon westwards to Europe. Commoner in the inner than the outer Himalaya and occasionally gregarious. Reaches 6-7 feet in girth and 35-40 feet in height but usually much under these dimensions. The wood is pinkish white, fairly hard and does not warp. It is not used. The growth is rather slow. The nuts are eaten. Flowers: March—April.

5. QUERCUS, Linn. (*The Oaks*.)

(The Latin name of the Oak.)

Trees or shrubs, (in the indigenous species) evergreen. Leaves alternate, penniveined. Flowers monœcious. Male flowers in pendulous catkins, bracts small, 1-flowered; perianth campanulate, 4-8-lobed or -partite; stamens usually 6-12, filaments slender, scarcely exceeding the perianth; pistillode usually 0. Female flowers with an involucre of small scales, solitary, axillary or in few-flowered spikes; perianth-tube adnate to the ovary, limb very minutely lobed or toothed; staminodes minute or 0; ovary 3-celled; ovules 2 in each cell; styles 3, stigmatose on the inner surface or at the apex only. Fruit (acorn) a 1-seeded nut seated on a cup formed from the enlarged and hardened involucreal scales. **DISTRIB.** Species (including *Pasania*) over 300; throughout the world excluding S. America, C. & S. Africa, S. India, Australia and the Pacific Islands.

The wood of all the indigenous oaks is brownish, very hard, with distinct paler colored sapwood and very indistinct annual rings. The medullary rays are of two classes, some very fine and some very broad, the latter causing a silver-grain on radial sections. The wood warps and shrinks in seasoning and except for ploughs is very little used as timber but is the favorite wood for fire-wood and charcoal in the hills. The size of the fruit varies considerably on the same tree. The description of the relative length of the nut to the cup is about the average for ripe fruits but in unripe fruits the cup is relatively longer often nearly enclosing the nut.

Young shoots and mature leaves beneath tomentose or pubescent.

Leaves always cuspidate-serrate, white-tomentose beneath, nerves straight ...

Leaves usually entire except on young plants and branches subject to browsing. ... 1. *Q. incana*.

Leaves brown- or rusty-tomentose beneath, lateral nerves forked

... 2. *Q. semecarpifolia*.

- Leaves grey-pubescent beneath, lateral nerves not forked, often obscure ... 3. *Q. flex.*
 Young shoots and mature leaves beneath glabrous or nearly so.
 Leaves green beneath, often entire, nerves mostly forked ... 4. *Q. dilatata.*
 Leaves pale and glaucous beneath, always serrate, nerves straight ... 5. *Q. glauca.*

1. *QUERCUS INCANA*, Roxb. Hort. Beng. (1814) p. 113.—An evergreen tree, bark dark-grey, young shoots and petioles hoary. Leaves 3-6 by 1-2 inches, oblong- or ovate-lanceolate, acuminate, cuspidate-serrate, coriaceous, dull greyish-green and glabrous above, densely white-tomentose beneath; lateral nerves 12-20 pairs, straight, parallel; petiole 4-6 inch long. Male catkins 2-4 inches long, slender, pubescent, usually interrupted; anthers 3-5, glabrous. Female flowers solitary or clustered in the leaf-axils on short stout peduncles; styles short, clavate, spreading. Acorn 8 inch long, half-enclosed by the campanulate cup when ripe. Collett Fl. Siml., fig. 154. *White Oak*. Vern. *Rín. rínj* (Haz. Rp.), *bán ban, bánj*.

Himalaya 3,000-8,000 feet. Trans-Indus to Nepal. Common and usually gregarious associated with *Rhododendron arboreum* and *Pieris ovalifolia*. Often on hot aspects and more conspicuous on the outer than the inner ranges. Often found growing with *Pinus longifolia*, mostly as an undergrowth towards the upper limits of the pine, less often it is found with blue pine and rarely with deodar. The regeneration is usually bad especially when the oak forms a large portion of the crop. I have seen good reproduction only in places covered with shrubs under which the oak seedlings are enabled to establish themselves. The growth is slow and seedlings are much damaged by cattle. The tree is lopped for fodder sometimes under rights but extensively illicitly. Trees in Government forests in Kangra are usually lopped till not a leaf remains, year after year, but privately owned trees are usually lopped every second or third year. The wood is very hard, reddish-brown, it warps and splits badly. It is used for ploughs but the main value of the tree is for firewood and charcoal for which it is excellent. Although usually worked under a coppice or coppice with standard system, this oak coppices badly except as a young tree. Nothing is known as to its rate of growth as in this species as well as in the other oaks the rate of the growth cannot be ascertained by ring counting. Flowers: April—May.

2. *QUERCUS SEMECARPIFOLIA*, Smith, in Rees Cyclop. XXIX (1819) No. 20.—A large evergreen tree, bark dark-grey, cut by shallow cracks into small more or less four-sided scales; young shoots tomentose. Leaves 2-5 by 1-3 inches, elliptic or elliptic-oblong, entire or on young trees spinous-toothed, apex usually obtuse, rounded, sometimes mucronate, rarely acute, rigidly coriaceous, glabrous and dark-green above, rusty- or brown-tomentose beneath; lateral nerves 6-12 pairs, forked, usually impressed on the upper surface, very prominent beneath; petiole 0-2 inch long, stout. Male catkins 2-6 inches long, softly pubescent; anthers 8-18, glabrous. Female flowers in few-flowered short spikes; styles 3-5, long, recurved. Acorn

1 inch diameter, subglobose, cup covering only the base of the nut which is brown when ripe. Collett, Fl. Siml., fig. 152 *Brown Oak*. Vern. *Banjar* (Haz.), *Kreu* (Chamba), *Karsu* (Bash.)

Himalaya 8,500-12,000 feet. Trans-Indus to Bhutan. Usually gregarious. Sometimes found forming nearly pure forests as on the Dhauladhar in the Kangra District where it ascends almost to the limit of tree growth, sometimes it is mixed with silver fir, spruce and deciduous broad-leaved trees such as maples and horse chestnut, at other times it is altogether wanting in the elevational zone it occupies and for no apparent reason. A larger and straighter growing tree than the other oaks reaching 80-100 feet in height with a girth of 8-12 feet or even more. It is a light-demanding species and consequently does not form dense forests except in the pole stage when the growth has all the appearance of coppice. Such growth can be well seen occupying a considerable area near Daranghati, Bashahr. It can hardly be due to previous fellings but may be the result of grazing. The timber is very hard, closegrained, light pinkish-brown, it would probably be more used if it were more accessible. It is used for firewood and charcoal in Dharmasala. The tree is much lopped for fodder when found near villages and seedlings have little chance of surviving except in remote and unfrequented localities as the brown oak forests are usually open to grazing. The seed ripens in July and August and germinates at once, often before it falls from the tree. Flowers: May-June.

There is a form of this tree in Kumaon and Tehri-Garhwal with the leaves glabrous beneath and often acute. It resembles *Q. dilatata*, but has the lateral nerves very strongly marked on the lower surface whereas *Q. dilatata* has them about equally marked on both sides and not very conspicuous on either. This form has not been collected as yet in the Punjab.

3. *QUERCUS ILEX*, Linn. *Sp. Pl.* (1753) p. 995.—A small evergreen tree, or large shrub, young shoots grey with stellate pubescence. Leaves .8-2.5 by .6-2.5 inches, variable, oblong or elliptic-oblong, obtuse or acute and mucronate, entire or coarsely spinous-toothed, base rounded or subcordate, coriaceous, margin recurved, lower surface densely grey, stellately pubescent or tomentose; lateral nerves 5-8 pairs, obscure in the entire leaves, more conspicuous in serrate leaves; petiole .05-.1 inch long, stout, tomentose. Male catkins 2-3 inches long, pubescent, slender, interrupted; anthers 4-12, hairy, shortly apiculate. Female flowers in pedunculate spikes reaching 2 inches in length; styles 3-5, spreading, clavate. Acorns usually 2-3 on a common peduncle up to 1.3 inches long, when ripe one-third to one-quarter sunk in a thick woody cup. *Holm Oak*. Vern. *Breh* (Kun.)

Inner dry valleys of the Himalaya 4,000-8,500 feet. Common in Kuna-war, Pangi and Kagan; not in the outer hills. Trans-Indus. Usually gregarious and associated with *Acer pentapomicum*, *Fraxinus xanthoxyloides* and (except in Kagan) *Pinus Gerardiana* with *Plectranthus rugosus* common in the undergrowth. Usually a small dense-crowned bushy tree but often only a large shrub. The tree is injured by cattle browsing and the leaves on low branches become very prickly-toothed much like those of the European Holly. It does not appear to be much lopped for fodder. The wood is not used. In the herbarium it is apt to be confused with *Q. dilatata* which has the same variability in the foliage but they can scarcely be confused in the field. *Q. Ilex* is a dull-green tree of hot dry aspects whereas *Q. dilatata* has bright green leaves and occurs in cooler and moister places. The leaves of *Q. dilatata*

are usually much larger than those of *Q. ilex* and never tomentose. Growth very slow. Flowers: April—May.

4. *QUERCUS DILATATA*, *Lindl. in Wall. Cat.* (1828) No. 2785.—A large evergreen tree; bark nearly black, exfoliating in scales, not very rough; youngest shoots and petioles with slight flocculent stellate pubescence, soon becoming glabrous. Leaves usually 2-4 by 1-2 inches, oblong-lanceolate or elliptic, entire or cuspidate-serrate especially on young trees, acute, mucronate, bright-green and glabrous on both sides, coriaceous; lateral nerves 8-12 pairs, mostly forked, about equally conspicuous on the two surfaces but not very prominent on either, reticulations distinct; petiole 1-3 inch long. Male catkin 2-3 inches long, much interrupted; anthers 4-8, glabrous. Female flowers in short axillary spikes; styles 3-5, the tips recurved. Acorns 1 inch long, one-third immersed in the hard cup. Collett, Fl. Siml., fig. 153. *Holly Oak*. Vern. *Barungi* (Haz. Rp.), *Moru*.

Himalaya 5,000-9,000 feet. Trans-Indus to Kumaon. A large tree reaching 80-100 feet in height by 20 feet girth. Often gregarious, sometimes associated with blue pine, the oak taking the moister places, at other times with deciduous broad-leaved trees when the oak takes the dryer places. In the lower portion of its zone it is frequently found with *Q. incana* and at the higher levels with silver fir or spruce. Regeneration is fairly good and it sometimes appears as an underwood in pole forest of blue pine, the blue pine on the other hand frequently comes up profusely under large oaks. The growth appears to be rather faster and the wood is better than that of the other oaks and is said to be durable but warps and shrinks in seasoning. It is chiefly used for firewood and charcoal. The acorns ripen in October and usually germinate soon after falling. Usually severely lopped for fodder. According to the Kangra Working Plan by G. S. Hart, paragraph 38, *Quercus dilatata* does not occur on the Dhaulta Dhar, a fact which has never been explained. Flowers: April—May.

5. *QUERCUS GLAUCA*, *Thunb. Fl. Jap.* (1784) p. 175.—A small or medium-sized evergreen tree; bark smooth grey, twigs glabrous. Leaves 4-7 by 1-3 inches, oblong, oblong-lanceolate or oblanceolate, acuminate, cuspidate-serrate except towards the base, coriaceous, glabrous and shining above, pubescent beneath with short silky hairs when young, afterwards glabrous or nearly so, glaucous; lateral nerves 10-14 pairs, straight, parallel; petiole 4-8 inch long. Male catkins 2-3 inches long; bracts lanceolate, silky, much longer than the flowers; anthers 4-5, glabrous. Female flowers 2-3 together on a short axillary peduncle; styles 3, with short broad spreading tips. Acorns 7 inch long, solitary or in pairs, the cup sessile, composed of tomentose scales arranged in 5-7 annular belts, covering the base only of the nut. Collett, Fl. Siml., fig. 155. Vern. *bānni*, *barin*.

Himalaya 2,000-6,000 feet from the Indus to Japan. Not gregarious but usually found in moist ravines and locally common, e. g. Kumalgali and Ghari Habibullah in Hazara. In Kangra at about 3,000 feet it is found

with *Q. incana* forming a coppice-like undergrowth with standards of *Albizia stipulata*. It is often found with *Acer oblongum*, *Machilus odoratissima*, etc. Reaches a height of 50-60 feet with a girth of 5-6 feet. An ornamental tree when well grown; it would probably grow better than *Q. incana* in the plains. Flowers: March—April.

QUERCUS PEDUNCULATA, Ehrh.—The *English Oak*.—This is grown in most hill stations but requires a deep soil or it becomes stunted. It suffers greatly from snowbreak except where the snowfall is light. The biggest specimen is in Abbottabad 6 feet 2 inches in girth and about 40 years old. There is one 4 feet 8 inches in girth and 60 feet high in Kulu. There are several at Ghoragali. It regenerates naturally in Kulu as do both the following.

QUERCUS CERRIS, Linn.—The *Turkey Oak*.—Grown in Dharmasala where it is stunted and at Monali (6,000 feet), Kulu, where it suffers from snowbreak.

QUERCUS RUBRA, Linn.—The *American Red Oak*.—Grown at Monali, Kulu, and suffers from snowbreak.

QUERCUS SUBER, Linn.—The *Cork Oak*.—Has been tried in Kulu and there is a tree still living in the Bandrol Garden. It has not thriven in Kulu and probably requires a warmer and dryer climate. Was introduced in December 1875 by plants imported in Wardian cases.

FAGUS SYLVATICA, Linn.—The *Beech*.—There are a number of specimens growing fairly well at Monali, Kulu. This tree and the foreign oaks are not likely to be of any economic value in the hills. They were mostly imported in 1876 by Mr. Baden Powell.

CASTANEA SATIVA, Mill.—A medium-sized (in India), deciduous tree. Leaves 5-10 by 2-3·5 inches, oblong or elliptic, acuminate, cuspidate-serrate, lateral nerves 12-22 pairs, conspicuous, parallel, bright-green and glabrous above, pale and more or less pubescent below; petiole 3-1 inch long. Flowers in erect axillary spikes 5-12 inches long, pale cream-colored, foetid, a few female flowers at the base of the spike. Male flowers 3 or more in the axil of each bract; perianth campanulate, segments usually 6; stamens many. Female flowers usually 3 in an involucre; perianth adnate to the ovary, limb 6-lobed; ovary 6-celled; styles 6, exserted from the involucre. Fruit up to 3 inches diameter consisting of the densely spinous involucre which splits into 2-4 valves and contains 1-3 chestnuts. *Sweet or Spanish Chestnut*.

Indigenous to S. Europe. Though introduced many years previous, the cultivation of *C. sativa* in N. India on a large scale dates from about 1878. It is found in most hill stations but as far as I have seen never ripens fruit in Abbottabad or Ghoragali possibly owing to lime in the soil which the tree dislikes. It is grown and fruits freely in many parts of Bashahr and Kulu but the fruits do not keep well. It grows and fruits well in Dehra Dun at 2,000 feet, so that it stands a great variety of climates. Seed has been distributed to villagers in Bashahr for many years in the hope that they would take up the cultivation of the tree but it has led to very little result. To grow the Chestnut the seed must be sown fresh and in a moist place and even then a large number of seeds come to nothing. The villagers in Bashahr are quite ready to plant and look after plants so that the best way to encourage the cultivation of the Chestnut is to make nurseries at Forest Rest Houses and distribute plants when 2-3 years old. Natural seedlings come up under the parent trees at Monali (6,000 feet), Kulu, and Nachar (7,500 feet), Bashahr. The tree does best on a deep porous soil but in the Himalaya it does not reach the proportions it does in Europe. The maximum height hitherto is 40-50 feet with a girth of 3-4 feet and the trees are branchy and suffer somewhat from snowbreak.

LXXXIX. SALICACEÆ.

Deciduous trees or shrubs. Leaves alternate, simple. Flowers dioecious or exceptionally monœcious, both sexes in catkins consisting of bracts each with one flower in its axil; bracteoles 0. Perianth 0. Disk of one or more glands or cup-shaped. Male flowers; stamens 2 or more, filaments usually free; pistillode 0. Female flowers; ovary 1-celled; ovules few or many on 2-4 parietal or subbasal placentas; style short or 0; stigmas notched or lobed. Fruit an ovoid or lanceolate 2-4-valved capsule. Seed minute enveloped in a mass of silky hairs attached to the funicle. **DISTRIB.** A small family chiefly in N. temperate regions.

Wood soft, not durable, pores and medullary rays very small and fine. Most species grow readily from cuttings and the larger are quick-growing but not long-lived trees.

Petioles short; disk of 1-2 glands ... 1. *Salix*.

Petioles long; disk flat or cupshaped ... 2. *Populus*.

1. **SALIX**, Linn. (*The Willows*).

(The classical name of the Willow.)

Deciduous trees or shrubs, sometimes dwarf. Leaves alternate (very rarely opposite), simple, usually lanceolate; stipules various. Flowers in catkins, dioecious (or sometimes monœcious with male and female flowers in the same catkin), each flower in the axil of a bract; perianth 0. Disk usually of 1-2 glands; when one, usually opposite the bract and when 2 are present, one opposite and one adjacent to the bract. Stamens 1-12, usually 2, filaments free or connate at the base or united up to the anthers. Ovary 1-celled, sessile or stipitate; style usually short or 0; stigmas entire, lobed or divided; ovules few or many, on parietal placentas towards the base of the ovary. Capsule 2-valved, when ripe the valves usually rolled back; seeds with a tuft of silky hairs. **DISTRIB.** Species about 160; chiefly in north temperate regions, Vern. *Bins, bains, bais, bed, bend*.

The genus is an exceedingly difficult one owing to the tendency to variation. The character of free and united stamens on which the main subdivision of the genus is based is by no means invariable and the length of the style and stipe of the ovary and shape of the stigma show considerable variation in the same species. Too much reliance is not to be placed on the color of the bracts though this character is distinctly useful. In fresh specimens I have found wide variation in the color of the bracts at the apex and base of the same catkin. Added to this is the difficulty of correlating the sexes, a difficulty which is by no means inconsiderable in the case of those species which flower before coming into leaf. In Europe very numerous natural hybrids are found but in India variation appears to account for aberrant forms rather than hybridization.

Key to the species from leaves and male catkins.

- I. Stamens 3-12.
 Leaves lanceolate or ovate-lanceolate, very pale beneath ... 1. *S. tetrasperma*.
 Leaves linear-lanceolate, usually entire ... 2. *S. acmophylla*.
- II. Stamens 2; filaments free.
 Dwarf shrubs of alpine situations; leaves not exceeding 1 inch long.
 Rachis of male catkins hairy.
 Petiole less than 1 inch long ... 8. *S. fruticulosa*.
 Petiole 2-3 inch long ... 9. *S. flabellaris*.
 Rachis of male catkins glabrous ... 10. *S. Lindleyana*.
 Small or large shrubs or small trees; leaves more than 1 inch long.
 Leaves linear-lanceolate with revolute margins, silvery-silky beneath ... 7. *S. viminalis*.
 Leaves broader, usually not silky.
 Male catkins on short leafy shoots ... 5. *S. elegans*.
 Male catkin subsessile or with a few small leaves at the base.
 A small shrub 3-5 feet high ... 4. *S. hastata*.
 Larger shrubs or small trees.
 Twigs glabrous or nearly so; leaves mostly rather coarsely serrate ... 6. *S. daphnoides*.
 Twigs more or less tomentose; leaves entire or serrulate, often silky ... 3. *S. Wallichiana*.
- III. Stamens 2, filaments connate throughout ... 11. *S. oxycarpa*.

Key to the species from leaves and fruiting catkins.

- I. Capsules glabrous.
 A. Small or large shrubs or trees; leaves more than 1 inch long.
 Capsules distinctly stipitate.
 Small trees; disk of 2 glands.
 Leaves lanceolate or ovate-lanceolate, very pale beneath ... 1. *S. tetrasperma*.
 Leaves linear-lanceolate, usually entire ... 2. *S. acmophylla*.
 A shrub 3-5 feet high; disk-gland solitary ... 4. *S. hastata*.
 Capsules subsessile or with the stipe shorter than the disk-gland.
 Stigmas subsessile; leaves 1-2 inches long ... 5. *S. elegans*.
 Style filiform; leaves 2-5 inches long ... 6. *S. daphnoides*.
- B. Dwarf shrubs of alpine situations; leaves less than 1 inch long.
 Rachis of female catkins hairy.
 Petiole less than 1 inch long ... 8. *S. fruticulosa*.
 Petiole 2-3 inch long ... 9. *S. flabellaris*.
 Rachis of female catkins glabrous ... 10. *S. Lindleyana*.

II. Capsules pubescent.

Stigmas subsessile.

Leaves 2-4 inches long ... 3. *S. Wallichiana*.Leaves 1-2 inches long ... 5. *S. elegans*, var.
hazarica.

Style distinct.

Leaves silvery-silky beneath ... 7. *S. viminalis*.Leaves glabrous or nearly so beneath ... 11. *S. oxycarpa*.

1. *SALIX TETRASPERMA*, Roxb. *Cor. Pl.* I (1795) p. 111
t. 97.—A medium-sized tree, bark with longitudinal furrows rough, young shoots silky. Leaves 2-5 by .6-1.8 inches, lanceolate or ovate-lanceolate, caudate-acuminate, towards the base of the shoots usually shorter, blunter and relatively broader, entire or more usually serrulate, green and glabrous above, pale or white beneath and more or less silky when quite young; petioles .3-.7 inch long; stipules on vigorous shoots semicordate, conspicuous, with gland-tipped teeth; Flowers appearing after the leaves. Male catkins 2-5 inches long, sweet-scented, sessile or on leafy shoots, rachis hairy; bracts obovate, concave, yellowish-brown, villous, not crowded, tip rounded or sub-acute. Stamens 5-10, filaments free, woolly towards the base. Disk of 2 yellow glands. Female catkins 1 inch long, on leafy shoots, rachis hairy, bracts as in the male but rather smaller. Disk semi-annular opposite the bract, yellow. Ovary ovoid; style 0; stigma 2-fid, each branch 2-lobed. Fruiting catkins about 2 inches long, rather lax; capsules glabrous, .15-.2 inch long, on a slender distinct stipe.

Sub-Himalayan tract and Salt Range along streams. Usually met with as a planted tree. Reaches a height of 30-40 feet and a girth of 6-10 feet. The wood has been tried for cricket-bats but is unsuitable. The heartwood is red, not durable and large trees are usually hollow. The plantation at Wazirabad on the banks of the Chenab consists largely of this tree. Occasionally planted on roadsides. Flowers: March—April; in the plains it sheds its leaves at the end of the rains and flowers in September.

2. *SALIX ACMORHYLLA*, Boiss. *Diagn. Ser.* 1, VII (1846) p. 98.—A small tree, bark rough with irregular mainly vertical cracks. Twigs slightly hairy when quite young. Leaves 2-5 by .2-.6 inch, rarely wider, linear-lanceolate, caudate-acuminate, entire or serrulate, green and glabrous above, not glaucous beneath, silky when quite young; petioles .1-.3 inch long; stipules minute. Flowers appearing after the leaves. Male catkins 1-2 inches long, on short leafy shoots, rachis villous; bracts ovate or oblong, concave, yellowish, very villous, rather crowded, tip rounded or sub-acute. Stamens 4-6, usually 6, filaments free, woolly towards the base. Disk of 2 yellow glands. Female catkins 1 inch long, on short leafy shoots, rachis villous, bracts as in the male. Disk opposite the bract, semi-annular, yellow, about one-third as long as the stipe of the

ovary. Ovary fusiform; style 0; stigma two-fid, branches entire. Fruiting catkins 1-2 inches long; capsules glabrous, about .2 inch long, on a slender distinct stipe.

Sub-Himalayan tract along streams. Trans-Indus to the United Provinces. Usually met with as a planted tree on roadsides and very frequently planted near water-mills. It is easily distinguished in the field from *S. tetrasperma* by its narrower leaves which are green beneath and usually entire but not so easily in the herbarium. Reaches a height of 30 feet and a girth of 5-6 feet with short straight trunk and compact rounded crown. Flowers: February—April.

3. *SALIX WALLICHIANA*, Anders. in Act. Holm. (1850) p. 447.—A shrub or small tree, twigs silky-tomentose, 1 year old twigs pubescent towards the tips. Leaves 2-4 by .6-1.2 inches, sometimes larger, ovate-lanceolate or oblong-lanceolate, entire or obscurely glandular-serrulate, silky on both surfaces when young, nearly glabrous when mature and glaucous beneath or persistently silky on both sides; petioles .2-.4 inch long; stipules minute or semi-cordate and coarsely toothed. Flowers before or sometimes with the leaves. Male catkins 1-1.5 inches long, nearly sessile with a few leaves at the base, dense, thick, very silky, rachis villous; bracts oblanceolate, densely silky on both sides, dark-brown. Stamens 2, filaments free, villous towards the base. Disk of a solitary erect gland opposite the bract. Female catkins 2-3 inches long, on very short leafy shoots, ascending, flexuous, rachis villous; bracts ovate-oblong, smaller than in the male, dark-brown, silky. Disk as in the male. Ovary ovoid, densely silky, on a minute stipe as long as the disk; stigmas subsessile, elongated, erect, each branch 2-fid. Fruiting catkins 1.5-5 inches long; capsules densely silky, scarcely stipitate, .25 inch long, with an elongated conical apex.

Himalaya 6-9,000 feet, especially in the inner valleys; Kagan, Pangl. A variable plant best recognized by its silvery-silky young leaves which are never coarsely toothed and often quite entire. One of the forms, var. *grisea*, differs from the type in having more slender shoots, narrower leaves and linear oblong acute bracts which are pale-brown in color; it occurs in Pangl. Var. *julacea*, with nearly glabrous bracts black at the tip and capsules less hairy with a stipe 3-4 times as long as the disk, occurs in Kagan. *S. Wallichiana* varies somewhat as to the length of the style. Flowers: March—June.

4. *SALIX HASTATA*, Linn. Sp. Pl. (1753) p. 1017.—An erect shrub branched from the base, twigs glabrous or with spreading silky hairs, 1 year old twigs glabrous, shining, dark-brown or purplish, rather stout. Leaves 1-3 by .5-2 inches, usually ovate or elliptic, clothed when young with loose tangled silky hairs, glabrous when mature, green above, paler green or glaucous beneath, serrate with gland-tipped teeth; petioles .1-.3 inch long, reddish; stipules on vigorous shoots conspicuous, ovate, glandular-serrate. Flowers with the leaves.

Male catkins 1-2 inches long, subsessile with a few small leaves at the base, thick, dense, very silky; rachis densely silky; bracts subspathulate, more or less densely silky, black or dark reddish-black towards the tips. Stamens 2, filaments free or not infrequently united either partially or up to the anthers, glabrous. Disk of a solitary erect gland opposite the bract. Female catkins 1-2 inches long, subsessile with a few small leaves at the base, thick; rachis silky; bracts as in the male but longer and more acute. Ovary glabrous, red, stipe twice as long as the disk gland; style filiform; stigmas usually spreading, branches 2-fid. Fruiting catkins 2-5 inches long; capsules glabrous, .2-.25 inch long, ovoid, beaked, stipitate.

Himalaya 9-15,000 feet, mainly in the inner ranges, Kagan and Siran valleys, Chamba, Kunawar, rare in the outer ranges but occurs here and there, e.g., Hattu. A shrub 3-5 feet high, best distinguished from *S. elegans* by its stouter silky catkins with dark bracts, long styles and much shorter peduncles; the large stipules on vigorous shoots are also not seen in *S. elegans*. Flowers: May—July.

5. *SALIX ELEGANS*, Wall. Cat. (1828) No. 3699.—A shrub often gregarious, twigs pubescent, 1-year old twigs glabrous, dark-brown. Leaves 1-2 by .6-.9 inch, elliptic, oblong or obovate, serrulate, bright-green above and silvery-pubescent especially on the midrib when young, glabrous when mature and glaucous beneath; petiole .1-.2 inch long; stipules minute. Flowers after the leaves, catkins often androgynous. Male catkins 1-2 inches long, on short leafy shoots, dense; rachis villous; bracts narrowed towards the base, apex rounded, truncate or minutely 2-3-lobed, ciliate, pale yellowish. Stamens 2, filaments very villous in the lower half, free or united by the hairs. Disk of a solitary erect gland opposite the bract. Female catkins 1.5-4 inches long, on leafy shoots, slender, flexuous, ascending; rachis villous; bracts as in the male. Ovary scarcely stipitate, ovoid-conic, stipe shorter than the disk-gland; stigmas subsessile, spreading, each stigma 2-lobed. Fruiting catkins 1.5-5 inches long, not dense; capsules glabrous, .15 inch long, very shortly stipitate. Collett, Fl. Siml. fig. 156.

Var. *HAZARICA*, var. nov.—Ovary and capsules silky-pubescent.

Himalaya 6-11,000 feet. Common, often forming a gregarious undergrowth in fairly moist forests. Extends to Kagan, Lahoul and Kunawar. Usually 4-10 feet in height. This is best recognized by its rather small leaves which are very pale and glaucous beneath and dark-brown twigs. In the Kagan and Siran valleys of Hazara the variety *hazarica* occurs at 10-11,000 feet and apparently replaces the type which has not been collected from that area. Flowers: March—April.

6. *SALIX DAPHNOIDES*, Villars, Hist. Pl. Dauph. III (1789) p. 765.—A large shrub or small tree, twigs pubescent when young, 1-year old glabrous or hoary, dark-brown, often covered

with glaucous bloom. Leaves 2-5 by .7-2 inches, lanceolate, elliptic or ovate-lanceolate, usually serrate, often rather coarsely so, with gland-tipped teeth, when mature puberulous on the midrib above, glabrous pale and glaucous beneath; petiole .3-.6 inch long, pubescent; stipules ovate, oblique, sometimes .5 inch long or more. Flowers before the leaves. Male catkins 1-1.5 inches long, nearly sessile with a few small leaves at the base, dense, thick, silky; rachis villous; bracts linear-ob-lanceolate, silky on both sides or glabrate on the back, dark-brown. Stamens 2, filaments free, glabrous. Disk of a solitary erect gland opposite the bract. Female catkins 2-4 inches long, on very short usually leafy shoots, rachis villous, bracts as in the male. Disk half surrounding the base of the ovary. Ovary glabrous, subsessile; style filiform; stigmas diverging, entire. Fruiting catkins 4-7 inches long; capsules glabrous, subsessile, including the style .25 inch long.

Himalaya 2,500-15,000 feet, common between 7,000 and 9,000 feet. Wood light-red. Cultivated in Lahoul for cattle fodder. Specimens showing the male catkins only are with difficulty distinguishable from *S. Wallichiana* unless the glabrous filament is a constant character. The pubescence of the 1-year old twigs in *S. Wallichiana* is usually well marked and is of assistance in separating the two. Flowers: March—May.

S. oxycarpa, var. *serrata*, Anders., is I believe a form of this species with connate filaments and paler bracts in the fruiting catkins and somewhat shorter style.

7. *SALIX VIMINALIS*, Linn. *Sp. Pl.* (1753) p. 1021.—A shrub or small tree, twigs silvery-tomentose, 1 year old densely hoary. Leaves 2-5 by .2-.7 inch, linear-lanceolate, often with revolute margins, hoary above when young, silvery silky beneath, entire; petiole .1-.5 inch long; stipules subulate. Flowers before the leaves. Male catkins 1-1.2 inches long, sessile, thick, dense, very silky; rachis densely silky; bracts lanceolate, dark-brown, with long silky hairs. Stamens 2, filaments free, glabrous. Disk of a solitary erect gland opposite the bract. Female catkins 2 inches long, sessile or subsessile with a few small leaves at the base, cylindric, bracts and disk as in the male. Ovary tomentose, subsessile; style filiform; stigmas deeply cleft, spreading. Fruiting catkins 2-2.5 inches long, very dense, stout; capsules .25 inch long, beaked, tomentose, subsessile. *Osier*.

Himalaya in the inner arid valleys 8-9,000 feet, Pangi and Kuna-war. Common along the Baspa river near Sangla growing with *Myrica elegans* and *Hippophaë*. One of the chief willows grown in Osier beds in Europe. Flowers: April.

8. *SALIX FRUTICULOSA*, Anders. in *Journ. Linn. Soc.* IV (1860) p. 53.—A dwarf shrub, branches rather stout mostly ascending, twigs hairy when young. Leaves .3-1 inch long, elliptic-lanceolate or oblanceolate, apex acute or rounded, gla-

brous, pale or glaucous beneath, crenulate; petiole less than .1 inch long. Flowers with the leaves, on very short leafy shoots. Male catkins .5-1 inch long; rachis densely hairy; bracts dark-purple, glabrous, oblong, apex rounded, truncate or retuse. Stamens 2, filaments free, villous near the base. Disk of a solitary erect gland (3-4 glands, *Brandis*). Female catkins .3-.8 inch long; rachis densely hairy; bracts and disk as in the male. Ovary nearly sessile, fusiform; style very long, deeply cleft; stigmas clavate, entire. Capsules glabrous, sessile, .15 inch long excluding the style. *S. furcata*, Anders. in DC. Prodr. 16, II, 291, fide Index Kewensis. *Brandis*, Ind. Trees, p. 638.

Alpine Himalaya 10-13,000 feet. Bashahr, Garhwal to Kumaon. Easily recognized by the very hairy rachises of the catkins and by the long deeply divided styles. Flowers: June.

9. *SALIX FLABELLARIIS*, *Anders. in Act. Holm.* (1850) p. 497.—A dwarf shrub, branches stout procumbent, twigs glabrous. Leaves .5-1 by .3-.6 inch, elliptic, obovate or sub-orbicular, acute or obtuse, crenulate, glabrous, pale or glaucous beneath; petiole comparatively long, .2-.3 inch long; stipules 0. Flowers after the leaves. Male catkins .5-1.5 inches long, terminal on short leafy shoots, cylindric, rather lax in the lower half; rachis puberulous; bracts obovate, brown, glabrous. Disk of 2 erect glands one in front and one behind the stamens. Stamens 2, filaments, free, glabrous. Female catkins similar to the male; disk half surrounding the base of the ovary. Ovary subsessile, glabrous; style distinct, short; stigmas spreading, entire. Fruiting catkins rather lax; capsules scarcely .15 inch long, ovoid, reddish, glabrous, almost sessile.

Alpine Himalaya mainly in the inner valleys 10-15,000 feet. Common in the Kagan and Siran valleys of Hazara also in Pangi and Kunawar. Flowers: June—July.

10. *SALIX LINDLEYANA*, *Wall. Cat.* (1828) No. 3697.—A small prostrate creeping and rooting shrub, twigs very slender glabrous or puberulous. Leaves very variable in size, oblong-lanceolate, entire, serrulate or crenulate, usually glabrous, glaucous beneath, narrowed into a petiole about .1 inch long or less. Flowers after the leaves, terminating leafy shoots. Male catkins .3-.5 inch long, few-flowered, rather lax; rachis glabrous; bracts oblong-obovate, glabrous. Stamens 2, filaments, free, glabrous. Disk of 2 erect glands one behind and one in front of the stamens. Female catkins similar to the male; disk half surrounding the base of the ovary. Ovary very shortly stipitate, glabrous; style distinct, sometimes long, deeply cleft; stigmas 2-fid. Capsules ovoid, .2 inch long, glabrous.

Var. MICROPHYLLA.—Leaves about .2 inch long, deeply channelled above down the centre, hairy beneath on the midrib, margins revolute,

Var. LATIFOLIA.—Leaves about 5-8 inch long, 2-3 inch wide, flat, glabrous, serrate.

Himalaya 11-14,000 feet. Kashmir to Sikkim. There are no Punjab specimens in Herb. Dehra. Anderson describes the style as minute but in the specimens it is distinct and often very long, in some cases as long as in *S. fruticulosa*. Flowers: June.

11. *SALIX OXYCARPA*, *Anders. in Journ. Linn. Soc. IV* (1860) p. 45.—An erect shrub, twigs pale-brown, slightly hoary when young, soon becoming glabrous and shining. Leaves 1.5-3.5 by .6-1.2 inches, elliptic-oblong, acuminate, base narrowed, glabrous except on the midrib above bright-green, pale glaucous and slightly puberulous beneath, serrate or sub-entire; petiole .1-.25 inch long; stipules very small, toothed or minute. Flowers appearing with the leaves. Male catkins 2 inches long, dense, short, subsessile, with a few small leaves at the base, silky; bracts spatulate, dark-brown, silky. Stamens 2, filaments connate throughout, glabrous. Disk of a solitary erect gland opposite the bract. Female catkins on short leafy shoots; rachis silky-pubescent; bracts oblong, silky, pale-brown, subacute. Ovary pubescent, stipe 2-3 times as long as the disk-gland; style very short; stigmas erect, bi-fid. Fruiting catkins 2-2.5 inches long, capsules silky-pubescent, ovoid-conic, stipitate. *S. oxycarpa*, *Anders. Fl. Brit. Ind., V, p. 636, ex parte.*

Dry inner Himalaya. Kishtwar to Kunawar 9-11,000 feet. Not common. Flowers: June. *S. oxycarpa*, var. *serrata*, *Anders.*, has been excluded from the above description and referred to *S. daphnoides* (*q. v.*)

SALIX INSIGNIS, *Anders.*—A large shrub branchlets tomentose, stipules semi-cordate; bracts of the female catkins black, obtuse; capsules hairy.

Pangi 12,000 feet. Spiti 11,000 feet. This appears to be intermediate between *S. daphnoides* and *S. Wallichiana*. It is very imperfectly known and is perhaps a hybrid.

SALIX PYCNOSTACHYA, *Anders.*—A shrub or small tree resembling *S. oxycarpa* in having monadelphous stamens. Leaves 2-3 by .5 inch or less, lanceolate, silky beneath when young, lateral nerves obscure. Flowers with or after the leaves. Male catkins 1 inch long on short leafy shoots or subsessile with a few small leaves at the base; bracts brown, ciliate with long hairs. Filaments hairy in the lower half, connate throughout or half-way. Female catkins 1.5 inches long, subsessile with a few small leaves at the base; bracts black at the tips. Capsules sessile, silky; style short, thicker at the top; stigmas 2, broad, bi-fid.

Arid inner Himalaya 12-14,000 feet. Zaskar and Ladakh, wild and cultivated. Burkill's No. 28619 and 28815 both from near Fagu, District Simla (8,700 feet) appear to be this species. They show male flowers and young leaves only. I have seen no other specimens from the Punjab.

The following species are cultivated most of them not very frequently:—

I.—Leaves broadly elliptic or obovate.

SALIX CAPREA, *Linn.*—A small tree, usually grown as a shrub for its sweet-scented male flowers. Leaves 2-4 inches long, ultimately glabrous and more or less rugose above, more or less grey-tomentose beneath, crenate

or nearly entire; stipules usually conspicuous, subreniform. Flowers before the leaves. Male catkins 1-1.5 inches long, sessile, stout, densely silky; bracts elliptic, acute, dark-brown, with long silky hairs. Stamens 2, filaments free, glabrous; disk-gland solitary. Female catkins a little shorter than the male, longer in fruit. Capsules downy, stipitate. *Sallow*. Vern. *Bed-mushk*.

Grown occasionally in native gardens. I have seen no specimens of the female tree from India. Indigenous to Europe.

II.—Leaves lanceolate.

A.—Twigs not drooping.

SALIX ALBA, *Linn.*—A fairly large tree, young twigs silky-hairy. Leaves 2.5-4 inches long, lanceolate, broadest a little above the middle, silky when young, glabrous when mature, often glaucous beneath, glandular-denticulate; petiole .3-.5 inch long. Flowers after the leaves. Male catkins 1-2 inches long on leafy peduncles; bracts oblong, ciliate, yellow. Stamens 2, filaments free, villous at the base; disk-glands 2. Female catkins a little longer than the male. Capsules glabrous, subsessile; style short; stigmas thick 2-lobed. *White Willow*.

Cultivated in the Himalaya but not often.

SALIX FRAGILIS, *Linn.*—A fairly large tree, twigs glabrous, fragile at the insertion. Leaves 2.5-6 inches long, lanceolate, broadest below the middle, caudate-acuminate, glandular-serrate, hairy when young; petiole up to 1 inch long, often glandular at the top. Flowers after the leaves. Male catkins 1-2 inches long, on leafy peduncles, bracts long, narrow, pale, hairy. Stamens usually 2 (sometimes more), filaments free, hairy; disk-glands 2. Female catkins longer than the male. Capsules glabrous, shortly stipitate; style short, 2-fid; stigmas 2-fid. *Crack Willow*.

Cultivated in Lahoul and Pangi.

B.—Twigs drooping.

SALIX BABYLONICA, *Linn.*—A medium-sized tree with pendulous branchlets. Leaves 3-7 by 4-1 inch, linear-lanceolate, acuminate, finely serrulate, glabrous or sparsely hairy beneath, hairy when quite young; petiole .2-.3 inch long. Flowers with the leaves. Male catkins .5-1 inch long on short leafy peduncles, silky; bracts small, pale. Stamens 2, filaments free, villous at the base; disk-glands 2. Female catkins as long as the male, slender. Capsules sessile, glabrous; style 0; stigmas spreading, rather large, usually entire. *Weeping Willow*. Vern. *majnun*.

Cultivated in the plains and hills. The male tree is much commoner than the female. Very easily recognized by its habit. The wood is suitable for making cricket-bats. Flowers: February—March.

2. *Populus*, *Linn.* (*The Poplars*.)

(The classical name of the Poplar).

Deciduous trees often with sticky buds. Leaves alternate, 3-5-nerved at the base, often lobed; stipules narrow, membranous, fugacious. Flowers in catkins, dicecious, pedicellate in both sexes, each flower in the axil of a bract; perianth 0. Disk cup-shaped, membranous or fleshy, often oblique, entire toothed or lobed. Stamens 4 to many; filaments free. Ovary 1-celled, surrounded at the base or up to three-quarters of its

length by the disk; stigmas 2-4; ovules many, on 2-4 parietal placentas. Capsules 2-4-valved, a placenta along the centre of each valve, valves spreading; seeds minute, with a long dense tuft of silky hairs. DISTRIB. Species 18; mainly north temperate.

Leaves lobed (or sometimes narrowly oblong and entire on young plants and suckers), buds pubescent, not sticky.

Leaves glabrous, polymorphous, entire on young

plants and suckers 1. *P. euphratica*.

Leaves white-tomentose beneath, always lobed 2. *P. alba*.

Leaves not lobed, buds sticky 3. *P. ciliata*.

1. *POPULUS EUPHRATICA*, Oliv. Voy. III (1801) p. 449, tab. 45, 46.—A large tree, bark on old stems thick rough, extremities sometimes hoary. Leaves on mature shoots 2-3 inches long, very variable, usually broader than long, rhomboid-orbicular or -ovate, sharply lobulate in the upper half, base 3-5-nerved; petiole .5-2 inches long, rather slender, usually with two large glands one on either side at the top; juvenile leaves 3-6 by .25-.5 inch, narrowly oblong, usually entire, the two surfaces similar; petiole usually .3-.6 inch long. Catkins lax, nodding, male 1-2 inches long, female 2-3 inches long. Male flowers; bracts oblanceolate, incised; disk orbicular, on a long slender stipe, flat, 8-cleft; stamens 8-12, anthers oblong, quadrangular, longer than the filaments. Female flowers; disk membranous, caducous, tubular, with 8-12 linear segments; stigmas 2-3, more or less crescent-shaped, narrowed into short styles. Capsules .3-.4 inch long, ovoid-lanceolate; pedicels .15-.2 inch long. Seeds enveloped in silky hairs. Brandis, Ind. Trees, fig. 198. Vern. *bhân*, *bâhan*.

Plains of the Punjab, confined to the banks of rivers. Not in the Sub-Himalayan tract or in the Punjab Himalaya. Along the Sutlej below Ferozepore and on the Indus from Dera Ismail Khan southwards. According to Stewart it is said to occur in nooks and corners along the main river between Attock and Dera Ismail Khan, but I did not see it once between Attock and Khushalgarh. It is common in Jhok Forest on the Ravi and stray specimens occur near Baloki. As neither Stewart nor Brandis mention the Bahan on the Ravi it is possible that these trees are not wild, but have spread from trees planted in Shahdara Plantation. Bahan seedlings spring up in abundance on fresh alluvial soil along river banks after the annual floods have subsided and ultimately form standards over an underwood of tamarisk. The Bahan reaches a height of 40-50 feet and a girth of 5-8 feet. The tree coppices well and produces root-suckers in great abundance often at a considerable distance from the parent tree. Artificial reproduction is difficult, attempts to propagate the tree by cuttings or by transplanting root-suckers have been unsuccessful. Occasionally planted in the plains. The growth is fast. Heartwood red or often nearly black near the centre, sapwood white moderately hard, compact, even-grained. It is used for well-curbs and for turnery. The leaves are lopped for feeding goats. Female trees are commoner than male. Leafless or nearly so from January March and flowers in February.

2. *POPULUS ALBA*, Linn. *Sp. Pl.* (1753) p. 1034.—A large tree, bark light-grey or whitish, smooth on young stems, dark and very rough on old stems, young shoots petioles and leaves beneath with dense soft cottony tomentum. Leaves 2-4 inches long, ovate, with obtuse sinuate lobes or those of luxuriant shoots 3-5-lobed and usually broader than long, when young cottony on the upper surface, persistently cottony-tomentose beneath, base 3-5-nerved; petiole 1-2 inches long. Catkins hairy, the male 2-4 inches long, the female shorter. Male flowers; bracts oblanceolate, ciliate, the tips slightly toothed; disk small; stamens 6-10. Female flowers; bracts as in the male; disk cup-shaped, crenulate; stigmas apparently 4 (actually 2, two-partite). Capsule .25 inch long, shortly pedicellate, 2-valved. *White Poplar*. Vern. *Saféda* (Haz. Rp.). *Mál* (Kunawar.)

Himalaya 4-10,000 feet. Wild near Ghoragali and in Hazara, fairly common in the Kagan Valley. Cultivated in Kunawar at Shong Tong, &c. If found in flower or fruit specimens should be collected and sent to herbaria as it has apparently not been collected in flower in India. "120 feet high and a girth of 14 feet at five feet from the ground" (Duthie, mss.) Produces root-suckers in abundance. Deep moist soil is necessary to enable the tree to reach a large size, but it will also grow in very dry and hot places and owing to its root-suckers it would probably be useful for afforestation work in the hills. It is cultivated occasionally in the plains, but does not do well in Lahore. It is often cultivated in Hazara and grows easily from cuttings. It makes a handsome road-side tree in moist deep soil in Hazara.

3. *POPULUS CILIATA*, Wall. *Cat.* (1828) No. 2796.—A large tree, bark greenish-grey smooth on young stems, brown with deep vertical fissures on old stems, buds sticky. Leaves 3-7 by 2.5-5 inches, broadly ovate, acuminate, crenate-serrulate, teeth minutely ciliate, base usually cordate, 3-5-nerved, pale and often minutely pubescent beneath; petiole 2-5 inches long. Catkins compact in flower, male 3-4 inches long, female in fruit lax, 6-12 inches long. Male flowers; bracts oblanceolate fringed with long hairs; disk obliquely cup-shaped crenulate; stamens many, anthers oblong, longer than the filaments. Female flowers; disk embracing half the ovary, margin undulate; stigmas 3-4, very large, obcordate. Capsule .3-.4 inch long, broadly ovoid, 3-4-valved; pedicels .1-.4 inch long. Seeds enveloped in long silky hairs. *Himalayan Poplar*. Vern. *Palách* (Haz.) *Phals* (Ku.) *Chalun* (Bash.)

Himalaya 4-10,000 feet. Trans-Indus to Bhutan. Common. Male trees are rare. Often on shaly hill sides and in such places small. It is sometimes common in forests of blue pine and acts as a nurse to the pine, but is soon outgrown and suppressed. In the Kagan Valley it is sometimes found in silver fir pole forests as clean-stemmed specimens of medium girth with a crown consisting of a few large limbs. Here too it is ultimately outgrown and suppressed by the fir. Sometimes common on islands and banks of streams and if not washed away it reaches large dimensions. It is usually not lopped for fodder in Hazara but in Kunawar it is often planted for lopping. Flowers: March—April.

POPULUS BALSAMIFERA, Linn.—A large tree, branchlets long, flexuose yellowish-brown or grey, buds sticky. Leaves 2-5 inches long, ovate, acuminate, subcoriaceous, glabrous, usually pale beneath, denticulate; petiole 1-3 inches long. Male catkins; rachis slightly winged; stamens 18-25; filaments slender, longer than the anthers. Female catkins up to four inches long in fruit; disk cup-shaped, crenate; stigmas 3-4. Capsule subsessile. *P. suaveolens*, Fisch. *Balsam Poplar*.

Indigenous to Central and North Asia and North America. Cultivated in Kunawar, Lahoul and Spiti, 8-13,000 feet. Lopped for fodder and planted for firewood. The American tree differs from the Asiatic chiefly in having purplish twigs, 2 stigmas and pedicellate capsules and is sometimes considered a different species.

POPULUS NIGRA, Linn., var. *PYRAMIDALIS*, Spach.—A large tree with fastigate branches forming a narrow cylindric crown, buds sticky. Leaves 2-4 inches long, broadly ovate-rhomboid, nearly as broad as long, glabrous, crenate, acuminate; petiole 1-2.5 inches long. Male catkins up to 3 inches long; bracts purplish; stamens 6-30, anthers purple. Female catkins up to 4 inches long; stigmas 2, sessile, broad, obcordate. Capsule shortly pedicellate. *Pyramidal Poplar*. Vern. *Saféda*.

The type, *P. nigra*, is indigenous to Europe and Central and Western Asia, it is not grown in India. The pyramidal variety probably originated in Asia and has been cultivated for a very long time in N.-W. India especially in Kashmir. Also cultivated in Kunawar and Hazara especially in graveyards. In India it rarely flowers and is always propagated by cuttings. It is occasionally grown in the plains but does badly in Lahore.

XC. AMARYLLIDACEÆ.

Perennial herbs rarely shrubs. Rootstock usually a bulb, tuber or corm, rarely erect. Leaves radical. Scape terminal, sometimes gigantic. Flowers bisexual, regular or nearly so. Perianth of 6 lobes or segments in two series. Stamens 6, opposite and adnate to the lobes of the perianth; filaments free or connate below; anthers usually linear-oblong, basifixed or versatile, cells 2. Ovary inferior, 3-celled, sometimes beaked; ovules many in each cell, biseriate, on the inner angle; style filiform or columnar; stigma simple or 3-cleft. Fruit capsular or succulent, usually loculicidally 3-valved. **DISTRIB.** A large family containing one naturalized genus of shrubby plants.

AGAVE, Linn.

(From the Greek *agavos*, admirable; referring to the stately flowers of some species.)

Stem short or produced as an erect or procumbent woody trunk. Leaves usually thick, fleshy, fibrous, arranged in a rosette, usually with marginal prickles and a strong terminal one. Inflorescence (in the following species) a huge panicle of cymes forming a pyramidal thyrus. Perianth-tube short. Stamens exceeding the perianth, Style filiform. Capsule often not

produced. Seeds flattened black. Species probably about 50; all American.

Leaves in a lax rosette, about 4 feet long; capsule rarely if ever produced ... 1. *A. Cantala*.

Leaves in a close rosette, not exceeding 3 feet long; capsule usually produced ... 2. *A. Wightii*.

1. *AGAVE CANTALA*, *Roxb. Hort. Beng.* (1814) p. 25.—Rootstock short ascending. Leaves forming a lax rosette, about 4 feet long, 3 inches broad at the broadest point which is just above the middle, pale-green often glaucous, curving gradually outwards from the base, the tips usually drooping, marginal prickles falcate ascending $\cdot 2$ inch long or more, terminal prickles acicular reddish or dark-brown $\cdot 5$ – 1 inch long. Scape with the panicle 12–18 feet high. Perianth greenish, lobes $1\cdot 5$ inches long, linear-lanceolate, obtuse, the tube very short. Capsule apparently never produced in India.

Native country unknown. Has long been introduced in India and is naturalized in many parts of the Punjab being the commonest species of the genus. It is common in hedges throughout the Kangra District and is often seen growing spontaneously. It covers a large rocky slope near Pat Rest House, Rampur, Bashahr. Grown in hedges in most large stations in the Punjab but less commonly in the west. Poles (*i.e.*, flowers) during the hot weather, produces no ripe capsules but buds develop and produce miniature plants (bulbils) which on being detached from the parent plant quickly take root. The plant also spreads by means of root-suckers. The fibre is often used by villagers. This plant as well as other species of the genus is likely to be useful in works of reclothing bare hills where the soil is poor as a temporary cover preparatory to the introduction of more useful plants. It can be grown up to 5,000 feet in the hills and *A. americana*, Linn. is growing well at greater elevations in Simla and is hardly out of doors in parts of England.

2. *AGAVE WIGHTII*, *Drummond & Prain, in Beng. Agric. Bull. No. 8* (1906) p. 15.—Rootstock often long and procumbent or shorter and ascending. Leaves forming a stiff compact rosette, 2–3 feet long, up to $3\cdot 5$ inches broad at the broadest point which is about the middle, pale-green often ashy, straight and stiff (except when grown in the shade), marginal prickles rather weak about $\cdot 7$ inch apart ascending, terminal prickles $\cdot 5$ inch long pale. Scape with the panicle 12–15 feet high. Perianth greenish-yellow, lobes scarcely 1 inch long, lanceolate, with narrow ligulate tips, the tube very short. Capsule $1\cdot 2$ – $1\cdot 5$ inches long, globose-ovoid.

Native country unknown. Naturalized in the Sub-Himalayan tract and outer Himalaya from the Kangra District eastwards but not as common as *A. Cantala*. On the other hand as a hedge plant in the plains it is commoner being preferred owing to its stiff and compact habit. Spreads by bulbils and suckers, the seeds if sown and watered germinate freely but do not assist the natural spread of the plant in the Punjab. Poles in the hot weather producing both bulbils and capsules. The fibre is good but as a fibre plant this species cannot be recommended where longer leaved species can be grown.

Many other species of this genus are grown in gardens and some will doubtless become naturalized in time. Drummond and Prain in Bengal Agricultural Bulletin No. 8 (1906) give the following key :—

Leaves in section flat to concave but never channelled throughout.

Teeth minute, close set A.

Teeth larger more or less remote.

Leaves in a lax rosette or tufted, never less than 3 feet in length.

Perianth-segments not constricted towards the tip.

Leaves broadest in the middle, tapering to both extremities.

Leaves oblong-lanceolate neck sharply constricted B. *A. americana*.

Leaves linear-oblong neck not constricted.

Marginal prickles in the upper part of the leaf pointing upwards, leaf deeply trough-shaped in the upper fourth C.

Marginal prickles pointing uniformly downwards, leaf flattish throughout D. *A. Vera-Cruz*.

Leaves hardly widened in the middle very narrow in proportion to their length.

Leaves linear-lanceolate curving outwards throughout their length, terminal spine acicular E. *A. Cantala*.

Leaves narrowly oblong, not curving, stiff, erect, terminal spine conical from a stout base F.

Perianth-segments narrowed from about the middle to the ligulate tip.

Leaves straight G. *A. sisalana*.

Leaves drooping from their upper third or less H.

Leaves in a close globose rosette never exceeding 3 feet in length I. *A. Wightii*.

Leaves in section caniculate K. *A. decipiens*.

SPECIES A.—This has not been identified, it is allied to *A. Keratto*, Mill. Leaves about 5 feet long, rather thick with a glaucous bloom, marginal prickles pointing both upwards and downwards.

Cultivated in Lahore. A.-H. Gardens and Government House.

B. AGAVE AMERICANA, Linn.—This plant is nearly always grown with variegated leaves the margins being pale-yellow and concavely indented between the large prickles which mostly point downwards.

Commonly grown in gardens in the plains and hills to 6,000 feet. Propagated by suckers as it rarely if ever poles in India. It is of no value for fibre. Easily recognized by its variegated leaves from other species except a variegated form of *A. Wightii* and a *Furcraea*. Both these have straight leaves which do not droop at the tip and are seldom grown.

SPECIES C.—This is closely allied to *A. Vera-Cruz*, Mill.

Cultivated in Lahore. Government House grounds.

D. AGAVE VERA-CRUZ, Mill.—Leaves 4-6 feet long about 10 inches wide at the widest point which is above the middle, usually very glaucous.

Grown in hedges in the S. E. Punjab, Rohtak. Cultivated in Lahore.

E. AGAVE CANTALA, Roxb.—See p. 512.

SPECIES F.—This has not been identified. It is allied to *A. sisalana*, Perr. It has not as yet been recorded from the Punjab but probably occurs. It resembles *A. Cantala*, Roxb., but has straight leaves seldom recurved at the tip.

G. AGAVE SISALANA, Perrine.—Leaves up to 6 feet by 10 inches, margin with or without prickles which if present are weak scattered and pale colored, deep-green sometimes glaucous. *Sisal Hemp*.

Cultivated in Lahore and has recently been tried in the Pabbi Hills. This species and *A. Cantala*, Roxb., are the best of any mentioned for fibre as far as is known.

SPECIES H.—This has not been identified. Leaves up to 7 feet by 10 inches, often very glaucous, marginal prickles distant at intervals of 1-2 inches.

Cultivated in Lahore. This is the largest *Agave* grown in India, the scape with panicle reaching 20 feet in height. It resembles *A. Vera-Cruz* in its glaucous foliage but in that species the marginal prickles are closer about 5 inch, rarely 7 inch apart. It will probably be met with in the East Punjab.

I. AGAVE WIGHTII, Drummond and Prain.—See p. 512.

K. AGAVE DECIPIENS, Baker.—Stem 3-4 feet high, erect. Leaves 2-4 feet by 3-5 inches at the broadest point which is just below the middle, fleshy, stiff, straight, marginal prickles very small but sharp, glossy apple-green.

Cultivated in Lahore and easily recognized by its bright-green leaves which resemble those of *Furcraea* in color but are smaller.

FURCREA, Vent.—Plants with the foliage and habit of *Agave*. Perianth-segments free to the base. Stamens not exceeding the perianth.

Two species are grown in gardens and hedges. They may be distinguished from *Agave* by their bright-green color and the terminal prickle of the leaf is either very small or absent.

FURCREA, SP. 1.—This has not been identified. Leaves 4-6 feet long, glossy above, smooth on both surfaces, margin with or without weak prickles tip unarmed. *Mauritius Hemp*.

Cultivated in Lahore. Not as common in the Punjab as the following species. There is a variegated variety which has only recently (1911) been introduced in the Punjab.

FURCREA, SP. 2.—This also has not been identified. Leaves a little longer but narrower than in the preceding, rough on the under surface ending in a small yellow-brown prickly 3 inch long.

Cultivated in the Punjab. It is commoner than the first species. Both are rather effective as single specimens in a garden and are usually seen as such but also occasionally in hedges. Poles during the hot weather.

XCI. DIOSCOREACEÆ.

Large herbs, usually climbing, with often a thick fleshy tuberous underground rootstock. Leaves alternate or opposite, simple or compound, costate and reticulate, petiole often angular and twisted at the base. Flowers small usually unisexual, panicle, racemose or spicate. Perianth superior, regular 6-cleft. Male flowers; perianth tubular or urceolate; lobes short, spreading. Stamens 6, all perfect, or 3 perfect with or without 3 staminodes, inserted at the base of the perianth or on its lobes, anthers small, the cells contiguous or on branches of the filament. Pistillode thick, fleshy or 0. Female flowers; perianth-segments free, smaller than in the male. Staminodes 6, 3 or 0. Ovary inferior, 3-quetrous, 3-celled; ovules 2 in each cell, superposed, pendulous; styles 3, very short; stigma entire or 2-fid, recurved. Fruit a berry or a 3-valved capsule. **DISTRIB.** A small family, tropical and subtropical.

The family contains no woody plants, but the following genus includes a number of climbers which are very common and conspicuous in the forest. The genus has recently been revised by Prain and Burkill, and their results are published in *Journ. & Proc. As. Soc. Beng.* Vol. X, No. 1 (1914) p. 5-41. The tubers of most species are dug up and eaten especially by Gurkhas. Some kinds are only edible after considerable preparation. Dioscoreas are often confused with species of *Smilax* from which they may be distinguished by the naked petioles, those of *Smilax* usually bearing cirrhi. The inflorescence and fruit are quite different in the two genera.

DIOSCOREA, Linn. (The *Yams*).

(In honor of Dioscorides, a native of Anazauba in Cilicia in the age of Nero; he was the author of a celebrated book on medicinal herbs.)

Leaves often bearing bulbils in their axils. Flowers unisexual, usually dioecious. Fruit a 3-winged capsule. Seeds compressed, often winged. **DISTRIB.** Species 150; tropical and subtropical.

Leave digitately compound.

Leaflets up to 4 inches long ... 1. *D. melanophyma*.

Leaflets larger ... 2. *D. pentaphylla*.

Leaves simple.

Stem twining to the right ... 3. *D. belophylla*.

Stem twining to the left.

Male spikes solitary often branched;
seeds winged all round ... 4. *D. deltoidea*.

Male spikes clustered, unbranched;
seeds winged on one side ... 5. *D. bullifera*.

1. **DIOSCOREA MELANOPHYMA**, Prain et Burkill, in *Journ. As. Soc. Beng.* IV (1908) p. 452.—Tubers edible, obovoid-rotund, densely covered with roots. Bulbils 2-3 inch diameter, numerous, black. Stem twining to the left. Leaves

alternate, 5- or 7-foliate or on slender shoots and towards the extremities 3-foliate or simple. Leaflets 1·5-4 by ·4-·9 inches, lanceolate, with a fine acuminate tip. Male spikes 1-3 inches long, axillary, solitary or in pairs. Stamens 3 and 3 staminodes. Female spikes about 1·5 inches long, solitary, axillary. Capsule ·6 inch long, oblong. (Seeds winged at the top?) *D. kumaonensis*, Kth. Fl. Brit. Ind., VI, p. 290. Collett, Fl. Siml., fig. 174.

Himalaya 4,000-7,000 feet. Hazara, Chamba, Kulu, Bashahr and Simla. "The bulbils of this plant are peculiar in structure; the outer coat is black and coriaceous or crustaceous and inside is a flat body having the appearance of a seed; the whole simulating a fruit." Collett. Flowers: August—September.

2. *DIOSCOREA PENTAPHYLLA*, Linn. *Sp. Pl.* (1753) p. 1032.—Tubers edible, oblong or clavate. Bulbils numerous pyriform or elongate. Stem twining to the left, prickly below. Leaves alternate, 3- or 5-foliate. Leaflets 4-7 by 1·2-2 inches, the central elliptic or oblong-ob lanceolate or -obovate, the lateral oblique, broader, finely acuminate, usually glabrous. Male spikes ·5-1 inch long, in large panicles. Stamens 3 and 3 staminodes. Female spikes 2-8 inches long, axillary, solitary or clustered. Capsule ·7-1 inch long, elliptic-oblong. Seeds winged at the top.

Himalaya and Sub-Himalayan tract ascending to 4,000 feet from Chamba eastwards. Not common. Flowers: September.

3. *DIOSCOREA BELOPHYLLA*, Voigt, *Hort. Suburb. Calc.* (1845) p. 652.—Stem enlarged at the base into a small rhizome from which fibrous-fleshy roots arise which enlarge into elongated tubers. Bulbils scarce, 1-2 inches long, smooth. Stem twining to the right. Leaves opposite or alternate, 2·5-6 by 1·2-4 inches, variable, usually ovate, acuminate, with a deeply cordate or sagittate base with rounded basal lobes, 9-11-nerved, glaucous beneath. Male spikes 1-1·5 inches long, 1-3 together in the leaf-axils or in leafless panicles. Stamens 6. Female spikes 1-5 inches long, usually solitary, occasionally 2-3 together, axillary. Capsule 1 inch long and as broad or a little broader, broadly obovate or obcordate. Seeds winged all round. *D. glabra*, Roxb. in Fl. Brit. Ind. *ex parte*.

Himalaya ascending to 5,000 feet and Sub-Himalayan tract from the Ravi eastwards. "The most highly prized of the forest yams, but often impossible to obtain owing to the tubers being wedged in the crevices of rocks" Haines. Flowers: September—October.

4. *DIOSCOREA DELTOIDEA*, Wall. *Cat.* (1828) No. 5110.—Tubers inedible. Stem twining to the left. Leaves alternate, 2-7 inches long, often as broad as long, ovate, acuminate, base more or less deeply cordate, lobes rounded sometimes dilated outwards, usually 9-nerved; petiole as long as

the blade, slender. Male spikes solitary, rarely in pairs, 3-15 inches long, lax, slender, often branched and forming a very lax panicle. Stamens 6. Female spikes 3-6 inches long, solitary, flowers few, distant. Capsule .7-1 by 1-1.3 inches, usually broader than long, variable in shape. Seeds winged all round. Vern. *kunj, kinch*.

Himalaya 3,000-8,000 feet (rarely to 10,000 feet) from Afghanistan to Nepal. The commonest species in the Punjab. The tubers are used for washing woollen cloth. Extends to Kagan, Pangi and Kunawar. Flowers: May—July.

5. *DIOSCOREA BULBIFERA*, Linn. *Sp. Pl.* (1753) p. 1035.—Tubers variable. Bulbils numerous, irregular in shape, 1 inch or more across, brown, warted. Stem twining to the left. Leaves usually alternate, about 4-6 by 3-4 inches, often much larger or smaller, ovate, acuminate, base more or less deeply cordate, lobes rounded, 7-11-nerved. Male spikes 2-4 inches long, clustered, axillary or in leafless panicles. Stamens 6. Female spikes 4-10 inches long, in axillary clusters of 2-5. Capsule .7-.9 inch long, oblong. Seeds winged at the base. *D. sativa*, Hook. f. *Fl. Brit. Ind.* VI, p. 295.

Himalaya ascending to 6,000 feet from Kashmir eastwards, common in the Sub-Himalayan tract in open scrubby places. Chamba, Bashahr, Simla. Also cultivated. The wild form appears to have acrid tubers which can only be eaten after considerable preparation and is hence not collected. Flowers yellowish-green tinged with purple, July—September.

XCH. LILIACEÆ.

Herbs, rarely shrubs or small trees, roots fibrous or root-stock creeping or a bulb or corm. Leaves various, sometimes minute and their functions performed by cladodes. Flowers usually 2-sexual. Perianth herbaceous or petaloid, usually 6-merous, 2-seriate, imbricate, rarely valvate in bud. Stamens 6, rarely 3 or fewer; filaments free or connate; anthers oblong or linear, often versatile, usually dehiscent longitudinally. Ovary 3-celled; ovules 2 or more from the inner angles of the cells; style usually long and simple, or styles 3. Fruit a 3-(rarely 1-) celled capsule or berry, 1- or more-seeded. Seeds globose or flattened. **DISTRIB.** A large family found throughout the World.

The family is of no forest importance but contains a number of showy plants belonging to the genera *Eremurus*, *Lilium*, *Tulipa* and *Gloriosa*. *Cordyline terminalis* is one of the few monocotyledons to undergo secondary thickening.

Stems leafy... .. 1. *Smilax*.

Leaves replaced by needle-like cladodes ... 2. *Asparagus*.

1. *SMILAX*, Linn.

(The old Greek name used by Theophrastus.)

Climbing, rarely erect shrubs. Leaves alternate, rarely opposite, persistent, 3-5-nerved and reticulate; petiole usually with 2 cirrhi at the top of the sheath. Flowers small, dioecious, umbellate. Perianth of 6 usually incurved or recurved segments. Male flowers; stamens 6 or more, at the base of the perianth, free; anthers 2-celled, oblong, with contiguous cells or with the cells separated by the forking of the filament. Pistillode 0. Female flowers; staminodes 3 or 6, filiform. Ovary 3-celled, 3-angled; ovules 1-2 in each cell, pendulous; style 0 or short; stigmas 3, stout, recurved. Fruit a globose berry. Seeds 1-2 (-3), albumen horny. *DISTRIB.* Species about 180; temperate and tropical.

- | | |
|--|---------------------------|
| Branches more or less prickly; flowers white, | |
| umbels in spikes | 1. <i>S. aspera</i> . |
| Branches unarmed; flowers purple, umbels solitary. | |
| Climbing, petioles cirrhose, leaves acute or | |
| acuminate | 2. <i>S. parvifolia</i> . |
| Erect, petioles eecirrhose, leaves usually | |
| obtuse | 3. <i>S. vaginata</i> . |

1. *SMILAX ASPERA*, Linn. *Sp. Pl.* (1753) p. 1028.—A climbing shrub, branches grooved, zigzag, more or less prickly. Leaves 2-4 by 1-2·5 inches, deltoid-ovate or lanceolate, acute or acuminate, margin often with small prickly teeth, base rounded, truncate or cordate, 5-9-nerved, prickly or not on the midrib beneath; petiole ·5-1 inch long, prickly or not, narrowly margined for one-fifth of its length, the sheath ending in 2 long cirrhi. Flowers ·3 inch across, white, arranged umbellately on the tumid nodes of axillary and terminal rachises 1-6 inches long. Bracteoles minute. Pedicels ·2-4 inch long. Sepals and petals ·15-2 inch long in the male, a little shorter in female flowers. Anthers linear, shorter than the filaments. Staminodes 6 in female flowers. Berry ·2-3 inch diameter, blue-black or translucent red. Collett, *Fl. Siml.*, fig. 175.

Outer Himalaya ascending to 6,000 feet from the Indus eastwards. Common, usually in scrubby places on warm aspects. Flowers: September—November.

2. *SMILAX PARVIFOLIA*, Wall. *Cat.* (1828) No. 5118.—A climbing shrub, branches somewhat angular, zigzag, unarmed. Leaves 1-4 by ·5-2 inches, very variable, ovate, lanceolate or oblong-lanceolate, acute or acuminate, entire, base rounded or subcordate, usually glaucous beneath, 3-5-nerved; petiole ·1-6 inch long, sheathed half-way up or more, usually cirrhose. Flowers ·15 inch across, purple, in axillary solitary umbels; peduncle variable in length up to 1 inch or more, very slender; pedicels up to ·4 inch long, filiform. Bracteoles

minute. Sepals and petals minute. Anthers didymous. Stamens 1-3 in female flowers. Berry .25 inch diameter, blue-black.

Himalaya 4,000-8,000 feet. Trans-Indus to Assam. Common. Extends to the inner valleys, Kagan, Chamba and Bashahr. This plant has been much confused with *S. elegans*, Wall.=*S. menispermoides*, A.D.C., a plant from Kumaon to Sikkim, which has flowers twice as large and much bigger sheaths to the petioles (.5-1 inch long in old leaves.) Flowers: April—May.

3. *SMILAX VAGINATA*, Desne. in Jacquem. Voy. Bot. (1844) p. 169, tab. 169.—A small deciduous shrub 2 feet high, branches terete, smooth, unarmed. Leaves 1-3 inches long, nearly or quite as broad as long, orbicular or broadly elliptic, obtuse or acute, entire, base rounded or subcordate, thin, glaucous beneath, strongly 3-nerved with 1-2 additional pairs of weaker nerves; petiole .3-.6 inch long, sheathed at the base, the sheath narrowed upwards, reaching one-half the length of the petiole, ecirrhose. Flowers .2 inch across, purple, in axillary solitary umbels, the female 1-flowered, rarely more-flowered; peduncle and pedicels filiform. Bracteoles 0. Sepals and petals minute. Anthers ovate. Stamens 6 in female flowers. Berry .3-.4 inch diameter, blue, glaucous.

Himalaya 6,000-9,000 feet, Trans-Indus to Assam. Common, especially in the inner Himalaya. A plant of moderately dry forest undergrowth usually gregarious in small patches under decidar. Flowers: May.

2. *ASPARAGUS*, Linn.

(From the Greek *sparasso*, to tear; referring to the spines of many species.)

Herbs or under-shrubs often climbing, stem dying to the ground periodically, root-stock various. Leaves reduced to minute scales, often spinescent, bearing in their axils tufts of needle-like or flattened branchlets (cladodes). Flowers small, 1- or 2- sexual, axillary, solitary, fascicled or racemed; pedicels jointed. Perianth petaloid, 6-partite, campanulate or spreading. Stamens 6, inserted at the base of the perianth-segments; anthers 2-celled. Ovary 3-celled; ovules 2 or more in each cell; style short; stigmas 3. Fruit a globose berry usually 1-seeded. Seeds with a brittle, shining, black testa and hard albumen. **DISTRIB.** Species about 100; temperate and tropical regions of the Old World.

Flowers solitary or in small clusters; cladodes in tufts of 2-8, straight ... 1. *A. gracilis*.

Flowers in racemes.

Cladodes .5 inch long or more.

Cladodes in tufts of 2-6; spines usually recurved ... 2. *A. racemosus*.

Cladodes in tufts of 6-20; spines straight ... 3. *A. ascendens*.

Cladodes .15-.25 inch long ... 4. *A. Curillus*.

1. *ASPARAGUS GRACILIS*, Royle, *Illustr. Bot. Himal.* (1839) p. 393.—A slender suberect undershrub, stems terete smooth. Lower leaves often transformed into small downward directed spines $\cdot 1$ inch long. Cladodes $\cdot 1\text{--}6$ inch long, in tufts of 2-8, needle-like or setaceous. Flowers solitary or in clusters of 2-8 often terminating short branchlets; pedicels $\cdot 1\text{--}2$ inch long, jointed at or below the middle. Perianth usually $\cdot 12$ inch long. Stamens half as long as the perianth; anthers very minute. Berry $\cdot 15\text{--}2$ inch diameter, red. *A. capitatus*, Baker.

Plains and dry places in the Himalaya ascending to 6,000 feet. Not uncommon in Kunawar near Kilba and in Hazara. A plant of dry places amongst shrubs in the Sub-Himalayan tract. Flowers: June—August.

2. *ASPARAGUS RACEMOSUS*, Willd. *Sp. Pl.* II (1799) p. 152.—A tall climber, stems annual woody terete, branchlets triquetrous, spines $\cdot 2\text{--}5$ inch long, recurved or rarely straight. Cladodes $\cdot 5\text{--}1$ inch long, in tufts of 2-6, curved. Flowers in solitary or fascicled simple or branched racemes $1\text{--}2$ inches long; pedicels $\cdot 2$ inch long, jointed in the middle. Perianth about $\cdot 12$ inch long. Stamens as long as the perianth; anthers very minute. Berry $\cdot 2\text{--}25$ inch diameter, red.

Sub-Himalayan tract and outer Himalaya ascending to 4,000 feet, from Kashmir eastwards. Hissar. Sometimes cultivated and ornamental when in flower. Flowers: October—November.

3. *ASPARAGUS ADSCENDENS*, Roxb. *Fl. Ind.* II (1832) p. 153.—Straggling or scrambling, stems woody striate minutely scabrid. Spines $\cdot 5\text{--}7$ inch long, straight or very slightly curved. Cladodes $\cdot 5\text{--}7$ inch long, in tufts of 6-20, straight, filiform. Flowers in numerous racemes $1\text{--}2$ inches long, racemes simple or branched often bearing cladodes towards the top; pedicels $\cdot 1\text{--}2$ inch long, filiform, jointed above or below the middle. Perianth scarcely $\cdot 1$ inch long. Stamens shorter than the perianth; anthers medium-sized. Berry $\cdot 2\text{--}3$ inch diameter, red.

Sub-Himalayan tract and outer Himalaya ascending to 5,000 feet, from the Indus eastwards. The commonest species in the Punjab. The young twigs minutely scabrid on the ridges between the striæ are characteristic of this and the following species. Flowers: October—November.

4. *ASPARAGUS CURILLUS*, Buch.-Ham. ex Roxb. *Fl. Ind.* II (1832) p. 152.—A tall climbing or subscandent under-shrub, stems woody, terete, branchlets striate minutely scabrid on the ridges between the striæ; spines $\cdot 3\text{--}7$ inch long, slender, slightly curved. Cladodes $\cdot 15\text{--}25$ inch long, in tufts of 3-6, nearly straight, flattened, linear, acute. Flowers in few-flowered racemes, racemes $\cdot 5\text{--}1\cdot 5$ inches long, solitary or 2-3 together, simple or branched, naked or bearing cladodes; pedicels $\cdot 1\text{--}2$ inch long, jointed at or below the middle. Perianth $\cdot 15$ inch

long. Stamens shorter than the perianth; anthers medium-sized. Berry .2 inch diameter, red.

Sub-Himalayan tract and foot of the Himalaya, 2,000-4,000 feet, from Sirmur eastwards. Flowers: July.

ASPARAGUS FILICINUS, *Buch-Hzm.*—A herbaceous species with curved flattened cladodes .2-4 inch long in tufts of 2-5 and solitary or paired flowers on long filiform pedicels. Common in moderately dry forest undergrowth between 6,000 and 10,000 feet.

ASPARAGUS OFFICINALIS, *Linn.*—The *Asparagus* of the vegetable garden is occasionally cultivated. Herbaceous, cladodes slender, subulate, .3-1 inch long, in tufts of 3-6. Pedicels solitary or paired, filiform.

ASPARAGUS PLUMOSUS, *Baker.*—Climbing, stems woody, green. Branches spreading horizontally with the branchlets and cladodes in one plane. Cladodes .3-5 inch long, in tufts of 6-12, soft, filiform. Pedicels solitary or paired.

Native of S. Africa. Grown in gardens and as a pot plant for its ornamental foliage. Easily recognized by its characteristic branching.

RUSCUS HYPOPHYLLUM, *Linn.*—A small shrub 12-18 inches high. Leaves replaced by phyllocladia 2-3 inches long, elliptic, coriaceous, abruptly pointed, midrib prominent, lateral nerves running mainly longitudinally and several of them reaching the tip. Flowers .15 inch long, umbellately arranged, arising usually from the the centre of the phyllocladia. Stamens 3, filaments connate.

Indigenous from Madeira to the Caucasus. Grown in gardens in the plains and common as a pot plant.

CORDYLINE TERMINALIS, *Kunth.*—An erect sparingly branched shrub 8-10 feet high. Leaves ascending, collected near the ends of the branches, 12-24 by 3-3.5 inches, lanceolate-oblong; petiole 4-6 inches long, deeply channelled. Flowers .4-5 inch long, white, in lateral lax panicles. Perianth-segments equal, a little longer than the tube. Stamens 6 dorsifixed. Ovules 6-10 in each cell. Fruit a berry.

Cultivated in gardens in the plains. There are many varieties with leaves red or purple on the margin or lower surface.

XCIII. PALMÆ.

Shrubs or trees. Stem solid, sometimes an underground rhizome but usually above ground, erect, procumbent or scandent, only exceptionally branching. Leaves alternate, usually crowded at the apex of the stem, plicate in bud, pinnate or flabelliform; petiole sheathing at the base, often armed. Flowers small, 1- or 2-sexual, usually 3-bracteolate, in lateral or less commonly terminal spikes or panicles (*spadix*), enclosed in bud by one or more large sheathing bracts (*spathes*). Perianth inferior, 2-seriate, usually of 6 lobes or segments, usually coriaceous, valvate or imbricate. Stamens usually 6 and opposite to the perianth-segments, sometimes 3 or 9 to many, filaments free or connate in a ring or tube; anthers 2-celled, versatile. Ovary 1-3-celled or of 3 carpels; ovules one in each cell or carpel; stigmas 3. Fruit usually a drupe. Seed usually erect

albumen horny or bony, uniform or ruminant, the embryo in a small pit in the albumen. **DISTRIB.** A large family; mainly tropical.

The wood of the Palms shows the typical monocotyledonous structure consisting of numerous vascular-bundles running mainly longitudinally, the bundles being surrounded as a rule by a sheath of bast-fibres. The intervening space is occupied by parenchymatose tissue. Towards the centre of the stem the vascular bundles are scattered and a cross-section shows mainly soft parenchyma but towards the outside of the stem the bundles are closely packed, the spaces between them being occupied by the confluent sheaths of bast-fibres. The stem is usually very hard towards the exterior and soft and spongy near the centre. The following account of the indigenous and cultivated palms is taken largely from "The Palms of British India and Ceylon" by E. Blatter starting in Vol. XX of the Journal of the Bombay Natural History Society. This article is copiously illustrated and should be consulted by those interested in the family as with palms a good illustration conveys a better idea of the plant than a detailed description.

- | | | | | |
|---------------------|-----|-----|-----|-------------------------|
| Leaves pinnate | ... | ... | ... | 1. <i>Phoenix</i> . |
| Leaves flabelliform | ... | ... | ... | 2. <i>Nannorrhops</i> . |

Key to include the cultivated species.

- | | | | |
|-------------------------------|-----|-----|------------------|
| Leaves bipinnate or decompose | ... | ... | <i>Caryota</i> . |
|-------------------------------|-----|-----|------------------|

Leaves pinnate.

Stemless or erect palms with stout or fairly stout stems.

- | | | | |
|--|-----|-----|---------------------|
| Lower leaflets spinescent; stem rough with the bases of the petioles | ... | ... | 1. <i>Phoenix</i> . |
|--|-----|-----|---------------------|

Lower leaflets not spinescent.

- | | | |
|--------------------------------|-----|-----------------|
| Stem covered with brown fibres | ... | <i>Arenga</i> . |
|--------------------------------|-----|-----------------|

- | | |
|--|-------------------|
| Stem smooth, not fibrous; leaf-sheath elongate | <i>Oreodoxa</i> . |
|--|-------------------|

- | | | | |
|-----------------------|-----|-----|------------------|
| Stem slender climbing | ... | ... | <i>Calamus</i> . |
|-----------------------|-----|-----|------------------|

Leaves flabelliform.

- | | | |
|---|-----|-----------------|
| Blade divided into 5-7 nearly free segments | ... | <i>Rhapis</i> . |
|---|-----|-----------------|

Blade not so deeply cut, with many more segments.

Petiole unarmed.

- | | | |
|----------------------------------|-----|--------------|
| Petiole prolonged into the blade | ... | <i>Sabal</i> |
|----------------------------------|-----|--------------|

Petiole not prolonged into the blade.

- | | | | |
|--|-----|-----|-------------------------|
| Tufted, stems branching, prostrate or under ground | ... | ... | 2. <i>Nannorrhops</i> . |
|--|-----|-----|-------------------------|

- | | |
|---|-----------------------|
| Single-stemmed, erect unbranched plants | <i>Trachycarpus</i> . |
|---|-----------------------|

Petiole armed with strong spines.

- | | | |
|------------------------------------|-----|-----------------------|
| Leaf-margin with long loose fibres | ... | <i>Washingtonia</i> . |
|------------------------------------|-----|-----------------------|

Leaf-margin not fibrous.

- | | | |
|--------------------------------|-----|--------------------|
| Stem nearly smooth, no suckers | ... | <i>Livistona</i> . |
|--------------------------------|-----|--------------------|

Stem covered with the bases of the petioles and with fibres, suckers commonly produced

Chorizandra

1. PHŒNIX, Linn.

(The old Greek name of the Date Palm used by Theophrastus.)

Low or tall dioecious palms. Leaves pinnate; leaflets entire, linear, folded longitudinally and attached obliquely by their folded bases to the woody common petiole, the lowest leaflets often transformed into spines; midrib 0 but a slender nerve on either side of the fold, nerves longitudinal parallel; leaflets in most species in fascicles of 4-6 arranged in the lower portion of the leaf in 2 or 3 rows on either side of the rachis, distichous towards the apex of the leaf. Flowers small, yellowish, coriaceous, on branched interfoliar erect or drooping peduncles; spathe basal, complete, coriaceous. Male flowers; calyx cup-shaped, 3-toothed; petals 3, obliquely ovate, valvate; stamens 6, filaments subulate, anthers erect, dorsifixed; pistillode 0 or minute. Female flowers globose; calyx as in the male, accrescent; petals rounded, imbricate; staminodes 6 or reduced to a 6-toothed cup; carpels 3, free; stigmas sessile, hooked. Fruit oblong, terete, 1-seeded, pericarp fleshy. Seed oblong, ventrally grooved. DISTRIB. Species about 11; Africa and Asia. Vern. *Kajúr*.

Tall palms 15-50 feet high.

No root suckers; crown dense, hemispherical ... 1. *P. sylvestris*.

Root-suckers copious; crown open ... 2. *P. dactylifera*.

Short palms, stems 0 or up to 12 feet high.

Stem 1-12 feet long; fruiting peduncle 2-4

feet long ... 3. *P. humilis*.

Stem ovoid, like a bulb; fruiting peduncle short,

usually hidden among the leaves ... 4. *P. acaulis*.

1. PHŒNIX SYLVESTRIS, Roxb. Hort. Beng. (1814) p. 73.—A tall graceful palm 30-50 feet high, stem rough from the persistent bases of the leaf-stalks, crown dense, hemispheric. Leaves 10-15 feet long, grey-green, glabrous, pinnate; petioles compressed only towards the apex. Leaflets 6-18 by 7-1 inch, glaucous, rigid, 2-4-farious, almost spinous-pointed. Male flowers white, scented, spadix 2-3 feet long, erect; peduncle much compressed. Spathes 12-16 inches long, scurfy, separating into 2 boat-shaped valves. Flowers 25-35 inch long, numerous, angular, oblique. Calyx cup-shaped with 3 short rounded teeth. Petals 3-4 times as long as the calyx, concave, warty externally. Filaments scarcely any, free, anthers linear, shorter than the petals. Female flowers; spadix and spathe as in the male. Flowers distant, roundish. Calyx cup-shaped, obsoletely 3-toothed. Petals very broad, convolutedly imbricate, leaving a small opening at the apex. Staminodes 3-4. Styles recurved, inwardly papillose. Fruiting spadix 3 feet long, nodding, the peduncle 1-1.5 inches broad, much compressed, golden-orange colored. Fruit 1-1.2 inches long, oblong-ellipsoid, orange-yellow, edible. *Wild Date Palm*.

Indigenous to the Sub-Himalayan tract from the Indus eastwards but not common west of the Ravi, also in the moist tract adjacent to the hills from the Ravi eastwards. Salt Range. Cultivated in the plains. The base of the stem is surrounded by a mass of small roots but root-suckers are never produced. The tree is rather variable, the stem sometimes being slender and showing scarcely any trace of the leaf-bases especially in the older and taller specimens, at other times it is clothed with the stumps of the petioles and resembles *P. dactylifera*. Rare in Hazara but is found at Nilan Bhoto, 3,500 feet. Common in Kangra and also in the Gurdaspur District. In some parts of India the Wild Date is tapped for its sugary sap which is used for making sugar. This does not appear to be practised in the Punjab but the trees are commonly mutilated by lopping, the leaves being used for mats and for putting under the mud of flat roofs. The Wild Date suffers very little from browsing and regenerates fairly well in moist tracts where the subsoil water is not deep. The stem is strong and is sometimes used for beams but the trees are rarely felled. It is the best wood for the pegs used for tent-pegging. The fruit is not esteemed. Flowers in the hot weather.

2. PHŒNIX DACTYLIFERA, Linn. *Sp. Pl.* (1753) p. 1188.—A tall palm reaching 100-120 feet in height, stem clothed with the stumps of the petioles, crown open. Leaves longer than in *P. sylvestris*, grey. Leaflets distichous, making a very acute angle with the rachis. Male flowers white, in short compact panicles 6-9 inches long. Fruit 1-3 inches long, sweet, edible, generally reddish- or yellowish-brown. *Date Palm*.

Indigenous to the Canary Islands, the Oases of the Sahara to Arabia. Naturalized in the South Punjab, Multan, Muzaffargarh, Dera Ghazi Khan and at Shahdara near Lahore. Often cultivated. The Date Palm was probably introduced at the time of the first Muhammadan conquest at the beginning of the 8th century. It thrives in an arid climate but requires plenty of moisture in the soil. It differs from *P. sylvestris* more in habit and mode of growth than by botanic characters, Drude in Engler and Prantl, *Pflanzenfamilien* suggest that it is not specifically distinct. The stem is commonly clothed with long stumps of the petioles which is seldom the case in *P. sylvestris*, the base of the stem is nearly always surrounded by suckers which is never the case with *P. sylvestris*. The crown is much more open and the leaves do not arch over so much as they do in *P. sylvestris*. The differences are excellently shown in the Palms of British India and Ceylon, E. Blatter, *Journ. Bomb. Nat. Hist. Soc.* XX, Plates II and VIII. The Date Palm is grown for its fruits which are protected from birds when ripening by tying a mat round the bunches. Flowers: March—April.

3. PHŒNIX HUMILIS, Royle, *Illustr. Bot. Himal.* (1839) p. 394.—A small palm, stem 1-12 feet high, densely covered with the stumps of the leaf-stalks, root-suckers frequent when the main stem has been injured. Leaves 4-8 feet long, pinnate. Leaflets 10-20 by 4-5 inch, pliable, fascicled, more or less quadrifarious, bases not thickened and not decurrent on the common petiole. Male spadix about 12 inches long, rather longer than the spathe. Fruiting spadix 3-4 feet long, the peduncle about 5 inch broad, compressed. Fruit 5 inch long, orange when ripe, edible.

This species is I believe common in the Kangra District but I may have mistaken young specimens of *P. sylvestris* for it. The North Indian form is var. *typica*, Becc. It is figured by Blatter l. c. Vol. XX, plate VI.

4. *PHŒNIX ACAULIS*, Roxb. *Hort. Beng.* (1814) p. 75.—A dwarf palm, stem not rising above the ground, bulb-like, 6-10 inches diameter, densely clothed with the sheaths and bases of the petioles. Leaves 2-6 feet long, pinnate. Leaflets 10-20 by 4-8 inch, stiff, the bases thickened and decurrent. Spadix 6-10 inches long, compressed, rather longer than the spathe. Male flowers pale-yellow. Fruiting peduncle short, usually concealed among the leaves. Fruit 5-7 inch long, oblong, blackish when ripe, edible. *Dwarf date palm.*

Sub-Himalayan tract near the Jumna. "There is no stem whatever, and the clusters of fruit are half buried in the ground." J. L. Stewart. Usually in grass-lands and undergrowth of Sal and *Pinus longifolia* forests. I have seen no specimens from the Punjab.

PHŒNIX RUPICOLA, T. Anders.—Trunk solitary, 15-20 feet high, naked. Leaves 10 feet long. Leaflets 18 inches long, flaccid, bifarious, bright green. Fruiting peduncle 3-4 feet long. Blatter l. c. Vol. XX, plate V.

Commonly cultivated in gardens in the plains. The handsomest of the genus and easily recognized by its bright-green, soft, bifarious leaflets. Indigenous to Sikkim and Assam.

PHŒNIX CANARIENSIS, *Hort. ex Chabaud.*—Trunk columnar, 40-50 feet high. Crown very large. Leaves 17-20 feet long. Female corolla scarcely longer than the calyx.

Indigenous to the Canary Islands. There is a fine specimen in Abbottabad but as it has long been grown in Saharanpur there are doubtless many more in N. W. India. As a frost-hardy large-sized palm this species can be recommended for cultivation for ornament. May be distinguished from *P. sylvestris* and *P. dactylifera*, the only members of the genus approaching it in size by the female corolla being more than twice as long as the calyx in those two species.

2. NANNORRHOPS, H. Wendl.

(From the Greek *nannos*, dwarf, and *rhops*, a bush; referring to the low growth. *DISTRIB.* Species only the following.)

NANNORRHOPS RITCHIEANA, H. Wendl. in *Bot. Zeit.* XXXVII (1879) p. 148.—A gregarious tufted low-growing palm, with robust prostrate branching stems or rhizomes, occasionally with an erect branching stem reaching 20 feet high. Leaf-blade 2-3 feet long and broad, cuneately flabellate, rigid, plicate, split to the middle or lower into 8-15 curved 2-fid segments often with interposed fibres; petiole 6-12 inches long, unarmed, concave, with a mass of rust-colored wool at the base. Spadix interfoliar, much-branched, pyramidal, 2-3 feet long, branches ascending and recurved, branchlets slender. Spathes tubular, sheathing. Flowers polygamous, bisexual and male, often in pairs, in the axils of distinct or connate bracts with hyaline margins. Calyx tubular, membranous, unequally 3-lobed. Corolla 15 inch long, 3-partite, segments valvate. Stamens in bisexual flowers 6, in male flowers about 9; anthers deeply sagittate. Ovary 3-celled, 3-angled; ovules basal; style short; stigma 3-toothed. Fruit 5-7 inch diameter, globose or ellipsoid. Seed ventrally hollowed, albumen uniform. Blatter l. c. Vol. XXI, plates XXI, XXII.

Salt Range, locally common in the central portion and at Sakesar. Trans-Indus. The fibre is used for ropes. The leaves are made into fans, sandals, baskets and brushes. The plant is gregarious in patches. It grows well under cultivation but is rarely seen. It has been grown in Saharanpur for over 50 years but has only recently been introduced in Lahore. It might be tried in the Pabbi Hills as the leaves and other parts of the plant appear to be used for many purposes and would probably bring in some revenue, if the plant could be successfully established. It is a native of very dry climates and likes a sandy soil. Flowers : August - November.

ABENGA SACCHARIFERA, *Linn.*—Stem 20-40 feet high, stout, densely clothed with the fibrous remains of the leaf-sheaths. Leaves 20-30 feet long, leaflets 4-fariously fascicled, up to 115 on each side, linear, 3-5 feet long. Flowers monœcious, spadices decurved with pendulous branches, appearing first from the upper leaf-axils and successively downwards.

Indigenous to Assam, Burma and Malaya. Cultivated in Delhi.

OREODOXA REGIA, *Kunth.*—Stem tall, smooth, annulate. Leaves very large, pinnate, bright-green, the sheath tightly enveloping the top of the stem. Leaflets quarifarious in the lower part of the leaf, more or less bifarious in the upper. *Royal Palm*. Blatter l. c. Vol. XXII, plate LXII.

Indigenous to the West Indies. Cultivated in Delhi and at Pinjore near Kalka.

RHAPIS FLABELLIFORMIS, *Ait.*—Stems many, tufted, 5-6 feet high, as thick as the thumb, sheathed by the reticulate persistent bases of the leaves. Leaves palmately divided almost to the base into 5-7 segments. Spadix 4-5 inches long, sparsely paniculately branched. Spathes 2-3, short, tubular. Blatter l. c. Vol. XX, plate XIII, fig. A. *Dwarf Ground Rattan*.

Indigenous to South China. Cultivated in Lahore. This species yields good walking-sticks called "ground-rattans."

CARYOTA URENS, *Linn.*—Stem 40-60 feet high, 1-1½ feet diameter, smooth, annulate. Leaves bipinnate, 18-20 by 10-15 feet, leaflets cuneate, 4-8 inches long, tip obliquely truncate. Flowers monœcious, the spadices appearing from the upper leaf axils and then successively downwards, after which the plant dies. *Fish-tail Palm*.

Indigenous to the hotter part of India and Malaya. Grown in gardens in Delhi and Amritsar.

CALAMUS TENUIS, *Roeb.*—Climbing, growing in clumps. Leaves pinnate, 18-30 inches long, the nerves and petiole armed with prickles. Leaf-sheaths and spadix with long whip-like prolongations armed with recurved prickles.

Indigenous to swampy places east of the Jumna. Cultivated in Lahore.

SABAL, *Adans.*—Tall or dwarf palms. Leaves flabellate, orbicular or cuneate at the base, tough and coriaceous, divided into many narrow 2-fid segments often with interposed fibres, the segments inserted obliquely on the sides of the prolongation of the unarmed petiole (rachis). Spadix interfoliar, elongate, decompound; spathes numerous, the outer acuminate enclosing the spadix in bud and persisting on its peduncle. Flowers bisexual, minute, white or greenish. Calyx tubular, unequally 3-lobed. Corolla deeply 3-lobed, the lobes concave, acute, slightly imbricate below, valvate at the apex. Stamens 6; filaments subulate, dilated below and connate into a shallow cup adnate to the corolla-tube; anthers ovate, the cells free and spreading at the base. Ovary 3-celled; ovules basal; style columnar, 3-lobed. Fruit usually obovate, small, nearly dry. Seed depressed globose, excavate at the base. *DISTRIB.* Species 20; all American.

SABAL ADANSONI, *Guersect.*—Stemless with a subterranean rhizome. Leaf-blade 18-36 inches long, one-half to three-fourths orbicular, divided into 20-35 entire or very shortly bifid segments; petiole about as long as the blade, the prolongation short. Spadix erect, 2-5 feet long. Fruit $\frac{1}{4}$ inch diameter, globular. Blatter l. c. Vol. XXI, plate 30. *Dwarf Sabal*.

Indigenous to the S. E. United States in low damp forests and inundated places. Cultivated in Lahore.

At least 3 other species of *Sabal* are in cultivation but their identification remains to be done.

TRACHYCARPUS EXCELSA, *H. Wendl.*—Stem 10-20 feet high, when young and up to middle age densely clothed with the bases of the petioles and with loose brown fibres, the tallest specimens clean and obscurely annulate. Leaves about 3 feet diameter, suborbicular, cut about half-way down into about 30-40 segments; petiole about as long as the blade, not prolonged into the blade, serrulate on the edges. Spadix shorter than the petioles, recurved in fruit. Drupe $\frac{1}{2}$ inch diameter, reniform. *T. Takii*, *Becc.*

Indigenous to Kumaon, Upper Burma, China and Japan. Cultivated in the plains and in the hills. It is quite hardy in Abbottabad and in Simla. In the plains it does not grow well, the leaves being small and dying off at the tips.

WASHINGTONIA FILIFERA, *H. Wendl.*—Stem 60-70 feet high, thickened near the base where it is 2-5-3-5 feet diameter, then cylindric and tapering near the apex, covered with dead, drooping leaves. Leaves nearly 6 feet long, orbicular, divided to about the middle into about 80 segments with long pale filaments between the segments, each segment 2-rid, the tips filamentose; petiole about as long as the blade, armed with spines on old plants, prolonged into the blade. Spadix elongate with many paniculate pendent branches. Fruit $\frac{3}{4}$ -1 inch long, ellipsoid, black.

Indigenous to the Southern United States. Has long been cultivated in Saharanpur and recently in Lahore. Easily recognized by the filamentose leaves. The variety grown in India has not been determined and it is possible that it may prove to be a closely allied species *W. robusta*, *H. Wendl.* the *Desert Palm* of Arizona.

LIVISTONA, R. Br.—Tall palms, trunks obscurely annulate. Leaves orbicular, flabelliform, split into numerous bifid lobes, petiole with spines on the margin. Spadix interfoliar, long peduncled, recurved in fruit. Spathes many, tubular, sheathing. Flowers minute, bisexual. Sepals 3, rounded. Corolla 3-lobed, valvate. Stamens 6; filaments connate in a ring; anthers cordate. Ovary of 3 nearly free carpels; styles free or coherent; stigmas minute. Fruit globose, oblong or ellipsoid. Seed hollowed on the ventral face. **DISTRIB.** Species 17; tropical Asia and Australia.

LIVISTONA CHINENSIS, *R. Br.*—Stem 20-30 feet high. Leaves 4-6 feet diameter, segments 50-60, the tips drooping; petiole up to 6 feet long. Fruit olive-shaped, $\frac{1}{2}$ inch long. Blatter l. c. Vol. XXI, plate XXVI.

Indigenous to China and Japan. This is the palm grown so commonly in pots and tubs in the plains and also out of doors. It has brighter green leaves than *Chamarops*, *Nannorrhops*, *Sabal* or *Trachycarpus*. It is not frost hardy and cannot be grown out of door in Abbottabad. Young plants should be protected from cattle as they are readily eaten.

CHAMÆROPS HUMILIS, *Linn.*—Stem dwarf or fairly tall, covered with the remains of the petioles and brown fibres. Leaves 18-24 inches diameter, cut three-fourths the way down into 12-20 narrow, stiff, slightly glaucous and downy segments; petioles 15-30 inches long, slender, spinous. Spadix short, erect. Spathes 6-8 inches long.

Indigenous to S. Europe. Grown in gardens in the plains. I have seen, the specimen in Lucknow figured in Journ. Bomb. Nat. Hist. Soc. XX, plate X, and doubt if it is *Chamærops humilis* or any species of *Chamærops*. Flowers: February—March.

XCIV. GRAMINEÆ.

Tribe BAMBUSEÆ.

Perennial woody grasses, often gregarious. Rhizome consisting in the case of tufted species of short, knotted, thick, solid growths from which are produced buds which develop as stems (*culms*) or in the case of single-stemmed species of long creeping branches producing buds at intervals from which the culms develop. Culms cylindric, jointed, hollow between the joints, joints or nodes prominent, the lower frequently with a fringe of abortive roots, each giving rise to a thin or coriaceous sheath (*culm-sheath*) which terminates in a more or less imperfect blade. Culm-sheaths alternate, bearing in the axil a bud, the buds at the lower nodes usually develop sparingly or not at all, the upper grow into half-whorls of branchlets sometimes of approximately the same size or one or more branches in each whorl, larger than the rest. Leaves distichous, usually linear, lanceolate or oblong-lanceolate, petiole very short, tip long-acuminate, midrib prominent, longitudinal veins of two classes the stouter (*secondary nerves*) with as a rule 5-7 fine intermediate veins between. Blade jointed on to the sheath which is amplexicaul and split to the base, with a transverse erect appendage (*ligule*) at the union with the blade and between it and the stem. Inflorescence usually a large compound panicle with spicate branches. Flowers in spikelets which consist of a number of distichous bracts (*glumes*) the lower 1 or more being empty and sometimes the uppermost also are empty or bear imperfect flowers. Flowering glumes 1-several in each spikelet, usually similar to the empty glumes but rather larger, each bearing in its axil a membranous usually hyaline bract (*palea*) which is usually 2-keeled and ciliate along the keels, between the palea and flowering glume is the actual flower which consists usually of 2-3 small scales (*lodicules*) representing a perianth and of stamens or a pistil or both. Stamens 3 or 6, rarely more or fewer; filaments capillary; anthers versatile. Ovary superior, 1-celled; ovule solitary, erect; style terminal; stigmas 2-3. Fruit a caryopsis, pericarp adnate to or separable from the seed. **DISTRIB.** Mostly tropical, especially Asiatic.

The growth of the culms in height occupies a few weeks during the rainy season and the size of the culms is closely connected with the abundance or otherwise of the monsoon. The culms first appear in June or July as conical growths protruding from the ground, covered with the imbricating culm-sheaths. The cone lengthens at first slowly but later with great rapidity, the sheaths get wider apart by the elongation of the internodes and in most species the sheaths fall off about the time the growth has ceased. Once the culm has risen a foot

or two above the ground the growth becomes so rapid that the increase day by day is easily noticed. Dr. Wallich measured a growth of 25 feet 9 inches in 31 days in the case of *Dendrocalamus giganteus*. During the period of growth the culms are soft and easily broken, consequently it is essential that bamboo forests be closed to grazing during this season. The culms of *Dendrocalamus strictus* take over 12 months to harden fully but they are safe from damage by cattle as soon as the rains are over. Flowering takes place either annually or periodically at long intervals. All the bamboos described below belong to the latter class. Periodic flowering usually takes place at one time with a species in a district, that is to say every clump of the species in the district will be found in flower unless it has flowered in the previous year or unless it is preparing to flower in the following year, as the flowering although taking place mainly in a certain year is spread over the following and preceding year or years to some extent. Bamboos which normally flower periodically may usually be found with here and there a culm or a whole clump in flower. After flowering the culm or clump or whole forest, if the forest consists of a bamboo which has flowered gregariously, dies as soon as the grain has ripened. Bamboos are easily propagated by seed, but it takes several years before seedlings have developed sufficiently to produce full-sized culms. A method commonly employed for propagating bamboos especially when seed is not available is to plant offsets. These consist of the base of a culm with a portion of the rhizome bearing a bud ready to develop into a fresh culm. The culm is cut off at a convenient height of 2-3 feet above the ground and the rhizome is dug up and replanted in the position where a new clump is required. Offsets should be planted at the end of the hot weather before the growth of the new culms has started. Offsets produce full-sized culms sooner than seedlings but they are more expensive to plant and there is a danger that the clump from which they were taken is about to flower when the culms raised from the offsets flower and die with the parent clump. In gardens bamboos are easily grown by cuttings or layers. In the absence of flowers bamboos are most readily recognized by the culm-sheaths. Several exotic Japanese species have been introduced in Simla and Abbottabad gardens. As ornamental plants they have the advantage over the indigenous hill species of being evergreen.

Small bamboos ; culms less than 1 inch diameter ;
stamens 3 ... 1. *Arundinaria*.

Large bamboos ; culms over 1 inch diameter ;
stamens 6.

Culms with the lower branches thorny or
culm-sheaths with large fringed auricles ;
pericarp adnate to the seed ... 2. *Bambusa*.

Culms without thorny branches ; culm-
sheaths without large fringed auricles ;
pericarp separable from the seed ... 3. *Dendrocalamus*.

1. ARUNDINARIA, Michaux.

(A diminutive of the Latin *arundo*, a reed.)

Erect, rarely climbing, shrub-like bamboos, usually tufted and growing gregariously. Culms slender, rarely over 1 inch diameter, nodes prominent, branches fasciculate. Culm-sheaths thin, papery, straw-colored, early deciduous ; imperfect blade narrow. Leaves usually small. Inflorescence paniculate or racemose, terminal on leafy culms or on separate culms or mixed with the leafy branches. Spikelets 1- to many-flowered, often long, compressed ; flowers mostly bisexual ; empty

glumes 2, membranous, unequal; flowering glume longer, concave, many-nerved; palea usually shorter than the flowering glume, strongly 2-keeled, usually compressed. Lodicules 3, ciliate. Stamens 3 (exceptionally up to 6). Ovary often hairy; style short; stigmas 2-3. Pericarp adnate to the seed. **DISTRIB.** Species 50; mostly Asiatic. Vern. *Ringal, nirgal*.

Transverse veins obscure. Culm-sheaths gradually narrowed from the middle upwards.

Bracts less than 1 inch long ... 1. *A. falcata*.

Transverse veins conspicuous. Culm-sheaths with the edges parallel to near the apex.

Bracts 2-3 inches long ... 2. *A. spathiflora*.

1. *ARUNDINARIA FALCATA*, Nees, in *Linnaea* IX (1834) p. 478.—Culms erect, 6-10 feet high, .3-.5 inch diameter, densely tufted, often glaucous, nodes swollen, internodes 6-12 inches long. Culm-sheaths as long as or longer than the internodes, gradually narrowed from the middle to a narrow truncate tip; imperfect blade .5-2 inches long, subulate. Leaves 3-4 by .2-.3 inch, sometimes up to 12 by 1 inch on young shoots; leaf-sheath glabrous; ligule membranous, dentate or lacerate. Inflorescence on separate leafless culms, consisting of falcate paniced racemes subtended by short linear or lanceolate bracts less than 1 inch long. Spikelets .5-.7 inch long, 2-, sometimes 1-flowered, some sessile others on long slender pedicels. Stigmas 2. Collett, Fl. Siml., fig. 199.

Himalaya from the Ravi to Nepal, 4-7,500 feet. Common in forest undergrowth on northern slopes or in moist ravines. The stems are used for making mats and baskets and for the stems of pipes and hookas. They are sold regularly in the forests of the Kangra Division.

2. *ARUNDINARIA SPATHIFLORA*, Trin. in *Mem. Acad. Petersb. sér. VI*, 3, ii (1835) p. 617.—Culms erect, 12-20 feet high, .5-.7 inch diameter, tufted, glaucous, with white scurf at first, nodes prominent not much raised, internodes 6-15 inches long. Culm-sheaths 5-8 inches long, edges parallel to near the apex, then narrowed to a truncately rounded tip .5 inch broad; imperfect blade 2-4 inches long, subulate. Leaves 3-5 by .4-.6 inch, transverse veins conspicuous dividing the leaf into numerous rectangles; leaf-sheath loose, ciliate on one edge bearing at the top short auricles furnished with a few long purple bristles; ligule ciliate. Inflorescence usually on separate leafless culms, consisting of fascicled drooping paniced racemes subtended by large papery bracts 2-3 inches long. Spikelets 1-2.5 inches long, 4-8-flowered. Stigmas 3.

Himalaya, 7-10,000 feet from the Sutlej to Nepal. Common in the undergrowth of deodar, fir, spruce and brown-oak forests. The clumps often grow close together forming thickets in which the separate clumps are scarcely distinguishable. Uses as for *A. falcata*.

The two following occur in the adjoining portion of the United Provinces and may be found in the Punjab. They should be looked for as they may easily be overlooked :—

ARUNDINARIA FALCONERI, *Benth. and Hook. f.*—This may be distinguished from *A. spathiflora* by the absence of transverse veins in the leaf and from *A. falcata* by the culm-sheath which is narrowed only at the top.

ARUNDINARIA JAUNSAEENSIS, *Gamble.*—This is easily recognized by its culms which arise singly from a creeping rhizome at intervals of 2-3 feet instead of in clumps. Leaves with numerous transverse veins, leaf-sheaths ending in falcate auricles which bear about 5-6 stiff bristles.

2. *BAMBUSA*, Schreb.

(From *bambu*, the Malay name.)

Erect tree- or shrub-like bamboos growing in dense or rather open clumps. Culms small to large. Culm-sheaths various, often with very large fringed crimped auricles. Leaves small to moderate-sized, transverse veins inconspicuous. Inflorescence a large compound leafless, rarely leafy, panicle. Spikelets 1- to many-flowered; empty glumes 1-4; flowering glumes ovate-lanceolate usually mucronate; paleæ 2-keeled, the keels ciliate or not. Lodicules 3, ciliate. Stamens 6. Ovary hairy above; style short or long; stigmas 1-3. Pericarp thin, adnate to the seed. *DISTRIB.* Species 50; one Australian, the rest Asiatic.

Culms distant unarmed, culm-sheaths on the backs with scattered adpressed black hairs, scabrid when the hairs have fallen ... 1. *B. nutans*.

Culms close, lower branches thorny, culm-sheaths ciliate when young otherwise glabrous and not scabrid ... 2. *B. arundinacea*.

1. *BAMBUSA NUTANS*, *Wall. Cat.* (1828) No. 5031.—Culms 20-40 feet high, 2-3 inches diameter, in very open clumps, naked or with a few unarmed branches below, bright-green, glaucous when young, internodes 16-18 inches long. Culm-sheaths 6-9 inches long or more, covered on the backs with scattered adpressed hairs, scabrid after the hairs have fallen, roundedly truncate at the top; imperfect blade very broad, acute, margins recurved, the base decurrent on the sheath and bearing large woolly auricles densely fringed with long curved bristles. Leaves 4-12 by 7-1.5 inches, secondary longitudinal nerves 7-10 on either side of the midrib. Spikelets few, fertile, many sterile, 7-1 inch long, glabrous; empty glumes 2-3 fertile flowers 3-5, followed by usually 2-3 imperfect flowers. *Vern. Nál.* (Kangra).

Cultivated by villagers in the Kangra District, 2-4,000 feet especially in the Palampur Tahsil. Indigenous to the Central and Eastern Sub-Himalayan tract. An elegant bamboo, the culms arch over gracefully at the

tops and are well furnished with foliage. The stems are bright-green and in rather open clumps which characters together with the absence of thorns on the lower branches enable this species to be recognized. The culms are strong and straight and are used for building purposes and for shafts.

2. *BAMBUSA ARUNDINACEA*, Willd. *Sp. Pl.* II (1799) p. 245.—Culms 40-60 feet high, 4-7 inches diameter, in very congested clumps, with numerous stiff leafless branches near the base, which bear strong curved thorns, bright-green, nodes very prominent, internodes 12-18 inches long, walls 1-2 inches thick. Culm-sheaths 9-12 inches long, striate, orange-yellow and thickly ciliate with golden hair when young otherwise glabrous, rounded at the top; imperfect blade triangular, sharply pointed, concave with involute margins, densely felted within with dark bristly hairs, the margins decurrent on the sheath, wavy, plaited, long and thickly ciliated but hardly auricled. Leaves usually not over 8 by .7 inch, secondary longitudinal nerves 4-6 on either side of the midrib. Spikelets .5-1 inch long, glabrous; empty glumes 0 or 1-2; flowers 3-7, the lower bisexual, the upper male, followed by 1-3 imperfect flowers. *Thorny Bamboo*. Vern. *Maggar* (Kangra).

Indigenous to most parts of India but not in the Indus basin or the valley of the Ganges. Cultivated in the Sub-Himalayan tract from the Ravi eastwards especially in Kangra, also in the plains. The clumps are usually very congested and the mass of stiff horizontal thorny branches make it difficult to approach the clumps which are consequently difficult to work. The culms are good and strong and are used for building purposes. Like *Dendrocalamus Hamiltonii* this species has been tried in the Kangra forests but without success. Sporadic flowering is not common but gregarious flowering is supposed to occur at intervals of 30-32 years but this applies to the plant in its wild state.

BAMBUSA VULGARIS, Schrad. Clumps open. Culms about 20 feet high, 2-3 inches diameter, bright-yellow with narrow green stripes running the length of the internodes and on alternate sides in adjacent internodes. *Golden Bamboo*.

Believed to have originated in China, cultivated in gardens and readily recognized by the color of its culms. There are several varieties of this plant differing in color but the above appears to be the only one grown and the most ornamental.

BAMBUSA NANA, Roxb.—Clumps dense. Culms 6-10 feet high, .5-1 inch diameter. Culm-sheaths 4-6 inches long, 2-3 inches broad, glabrous; imperfect blade decurrent on the sheath deciduously ciliate. *Hedge Bamboo*.

Indigenous to China and Japan. Cultivated occasionally in the plains. It makes an excellent hedge if planted close and well trimmed but is usually seen as a single clump.

3. *DENDROCALAMUS*, Nees.

(From the Greek *dendron*, a tree and *kalamos*, a reed.)

Erect, tree-like bamboos, usually growing in dense clumps. Culms medium-sized or large. Culm-sheaths deciduous, often very large, imperfect-blade narrow-triangular. Leaves variable, sometimes very broad, transverse-veins absent. In-

florescence a large compound panicle. Spikelets few-flowered usually in globose heads; flowers usually bisexual; empty glumes 2-3, many-nerved; flowering glumes similar to the empty; palea of the lower flowers 2-keeled, ciliate, of the upper flowers usually rounded, on the back eciliate. Lodicules 0 or rare. Stamens 6. Ovary hairy above; style long, usually hairy; stigma usually simple. Pericarp coriaceous or crustaceous, separable from the seed. **DISTRIB.** Species 16; Asiatic.

Culms 1-3 inches diameter; leaves rarely over 1 inch wide; spikelets spinescent, yellowish 1. *D. strictus*.

Culms 4-7 inches diameter; leaves over 1 inch wide; spikelets soft, purple ... 2. *D. Hamiltonii*.

1. *DENDROCALAMUS STRICTUS*, Nees, in *Linnaea* IX (1834) p. 476.—Culms densely tufted, 20-40 feet high 1-3 inches diameter, glaucous when young and covered with white scurf, often solid or nearly so near the base, internodes 10-15 inches long. Culm-sheaths a little shorter than the internodes, glabrous or with blackish stiff hairs, striate, rounded at the top, ciliate at the edges, very slightly auricled; imperfect-blade elongate-triangular, hairy especially within. Leaves 1-10 by 2-1.2 inches; leaf-sheaths striate, hairy, ending in a prominent callosity and short auricles with a few deciduous cilia. Spikelets spinescent, in dense globular heads which are 1.5-4 inches apart, 1-1.5 inches diameter. Stamens yellow. *Male Bamboo*. Vern. *Bāns*.

Indigenous to the Sub-Himalayan tract, common east of the Ravi, rare to the west, 1-2,500 feet. The extreme limit of this bamboo is the Margalla Reserve, Rawalpindi District, it is not found in Hazara and is very scarce in Rawalpindi. It is found at a few places in the eastern portion of the Salt Range and in Shahpur Kandi. It is not sufficiently common to be of any importance until the Kangra District is reached where it is found scattered in many of the scrub forests. The most extensive areas are the Khanpur and Bindaraban Reserves in the Hoshiarpur District and there is a good deal of bamboo in the Native States draining into the Sutlej. This bamboo appears to require good drainage as it avoids flat ground. There is much information as to its sylviculture and requirements and the methods of working bamboo forests in the Indian Forester (*vide* B. A. Rebsch "The Bamboo Forests of the Ganges Division, U. P.," Vol. XXXVI, 1910, p. 202) as well as in the Kangra Working Plan by G. S. Hart. In dry places almost completely deciduous, the leaves falling in February or March. Flowers gregariously at long intervals but also sporadically, a certain amount of seed can be collected every year in Kangra. Flowers: November—April, the seed ripening in June.

2. *DENDROCALAMUS HAMILTONII*, Nees, & Arn. ex Munro, in *Trans. Linn. Soc.* XXVI (1868) p. 151. Culms fairly densely tufted, 40-60 feet high, 4-7 inches diameter, greyish-white when young with dense adpressed pubescence, dull-green when old, usually naked below often with very long branches arising

singly from the upper nodes, nodes towards the base of the culms, often with small abortive rootlets, internodes 12-20 inches long, walls .5 inch thick. Culm-sheaths as long as the internodes or shorter, stiff, persistent, glabrous or with scanty patches of brown stiff adpressed hairs without, truncate at the top and furnished on either side with small glabrous triangular auricles; imperfect blade often 12 inches long, narrowly ovate-lanceolate, about three-fourths as broad at the base as the top of the culm-sheath, glabrous without but with black sharp hairs at the base within. Leaves 2-18 by .5-4 inches; leaf-sheath with a prominent shining callus at the apex. Spikelets soft, in semi-globular heads which are 2 inches or less apart, .7-1.5 inches diameter. Stamens purple. Vern. *Mohr* (Kangra.)

Indigenous to Nepal and the North-East Himalaya. Commonly cultivated by villagers in the Kangra District. The large culms sell for about 4 annas each in Kangra so that efforts have been made by the Forest Department to grow it in the forests. It has not proved a success and although it will live for many years when planted in the forest the shoots are small and worthless. The village clumps are manured by throwing the old grass from thatched roofs round the clumps and are always seen on good or fairly good soil. This bamboo is best recognized by its dull-green culms and by the large leaves which are almost always seen on some of the branches. In some years a clump here and there may be found with a few culms flowering. The culms are rather soft for building but are largely used for baskets, mats, screens, etc.

To this family belong the cultivated cereals and grasses. Large forest grasses are not a conspicuous feature in the Punjab as they are in almost all the rest of India, nor is grass of much importance apart from its value for grazing and thatching. The following species are the most noticeable:—

SACCHARUM MUNJA, *Roeb.*—Perennial tufted. Stems 10-20 feet, in dry places only 6-7 feet high, glabrous below the panicle. Leaves, the lower up to 7 feet long, 7 inch wide, or occasionally 1 inch or only .15 inch wide, sheath shortly silky at the extreme base, villous at the apex. Spikelets very numerous, awnless, 1-flowered, in panicles 1-3 feet long, the spikelets in pairs one sessile one pedicelled, both similar, surrounded by hairs shorter than or equal to the length of the spikelet. Empty glumes 3, the two lowest subequal, the uppermost smaller but larger than the flowering glume. *S. arundinaceum*, Hook. f. in Fl. Brit. Ind. VII, p. 119, *ex parte*. Vern. *Sar*, *sarkāna*, *sarkānda*, *munj*, *kānd*.

Throughout the plains of the Punjab in low sandy places along canals and rivers in places subject to inundation. Springs up after the fellings in flooded and irrigated plantations often in dense masses but dies out as soon as it is overtopped by the coppice shoots. The upper leaf-sheaths of the flowering stems yield fibre (*munj*) used in place of coir for matting and extensively for cordage and ropes, especially ropes used on rivers and liable to get wet constantly. Log and sleeper rafts are all tied with *munj* ropes. The thin portions of the flowering stems (*sirhi*) are used for trays, screens, etc. The thick portions of the flowering stems (*kānd*) are used for coarse screens. *Sar* is the name used for the leaves which when young are used as fodder. (*Vide* Hole, "Some Indian Grasses and their Oecology," Ind. For. Mem. Bot. Ser. I, i, 1911.)

SACCHARUM SPONTANEUM, Linn.—Perennial not forming well-defined tufts. Stems 5-12 feet high, silky below the panicle. Leaves up to 4 feet by 7 inch wide. Panicle 6 inches to 2 feet long, spikelets surrounded by hair 1.5-7 times as long as the spikelets. Otherwise as for *S. Munja*. Vern. *káns, káhi, kán*.

Throughout the plains of the Punjab especially on islands and banks of rivers. Used for thatch, *chiks* and as fodder for buffaloes.

ISCHÆMUM ANGUSTIFOLIUM, Hack.—This is the *Bhabar* grass of the United Provinces which is used for rope and paper making. Found in the Outer Himalaya and Sub-Himalayan tract from the Indus eastwards but is not sufficiently common to be of importance in the Punjab. Vern. *Baggar*.

The *False Bhabar*, *Eriophorum comosum*, Wall., is commoner than the true Bhabar, it is usually found on steep rocky banks. It is not a grass but a sedge (Cyperaceæ) and may be distinguished when not in flower by the absence of the woolly base of the stem which is found in the true Bhabar. It is used for the same purposes but is inferior to the true Bhabar. Vern. *gor-baggar*.

THYSANOLÆNA AGROSTIS, Nees.—*Broom Grass*.—A tall grass easily recognized by its broad leaves 1-2 feet by 2-4 inches and large panicle of very numerous minute 1-flowered spikelets. It is common and conspicuous in Kangra especially in moist shady ravines and is grown for ornament in gardens in the plains. The stems are used for reed pens used for writing vernacular and for making brooms.

CYNODON DACTYLON, Pers.—This is the *Dáb* grass of Europeans (but not of natives in the Punjab.) It is abundant on roadsides, grazing-grounds, etc., but not in very dry places. It is one of the best fodder grasses but does not grow tall. It is universally used for lawns as it stands cutting well. Vern. *Kabbal* (*dáb* in Hindoostan).

XCV. GNETACEÆ.

Shrubs, erect or climbing, resin-ducts absent. Leaves opposite, whorled or reduced to a short 2-4-toothed sheath; stipules 0. Flowers unisexual, dicecious, rarely monœcious, in axillary or terminal spikes or cones. Male flowers; perianth 2-lobed, valvate or spathaceous; filaments connate in a column; anthers 2-8, globose, 1-3-celled, sessile or subsessile on the column, dehiscing by short apical slits. Female flowers; one erect ovule with one integument prolonged into a tube (*tubillus*) which has the functions of a style, and enclosed in a single or double perianth. Fruit (in the following species) fleshy consisting of succulent bracts enclosing 1-2 seeds. Embryo with two cotyledons. **DISTRIB.** A small family widely distributed.

EPHEDRA, Linn.

(A classical name for the Horsetail, *Equisetum*, applied to this genus owing to the resemblance in habit.)

Leaves reduced to sheaths at the nodes of the branches. Male flowers in short bracteate spikes which are whorled or in pairs. Female flowers in pairs or sometimes 3 or solitary. **DISTRIB.** Species 31; Mediterranean Regions to the Himalaya, Andes and Rocky Mountains from Chile to California.

Tall scandent shrubs with slender branchlets ... 1. *E. foliata*.

Rigid erect shrubs with usually many stems from a stout rootstock.

Male spikes 1-3 together at the nodes ; tubillus straight ; internodes smooth or slightly rough... ... 2. *E. Gerardiana*.

Male spikes in dense whorls at the nodes ; tubillus twisted ; internodes rough ... 3. *E. intermedia*.

1. *EPHEDRA FOLIATA*, Boiss. *Fl. Orient.* V (1881) p. 716.—

A tall scandent shrub, stem up to 3 inches diameter, bark on the branches exfoliating in fibrous shreds. Branchlets very slender often filiform, dull-green, usually whorled, internodes 1-4 inches long ; leaf-sheaths short, often bearing 2-4, linear-setaceous blades ; blade sometimes 1 inch long but usually only .1-.2 inch long. Male spikes ovate, solitary or 2-3 together sometimes with a peduncle 1-1.5 inches long ; flowers 6-24, bracts rotund, obtuse, connate, .06-.08 inch long ; staminal column equaling the perianth or shortly exserted, anthers 3-4. Female spikes often in small cymes, pedunculate, flowers usually in pairs ; tubillus exserted, short, straight. Fruit .3 inch long, ovoid, white, translucent, showing 2 dark-colored seeds. *E. peduncularis*, Boiss.

Punjab plains mainly in the southern portion. Salt Rage. Climbs over small trees and covers them with a dense mass of branchlets similar to *Cuscuta reflexa* at a little distance but of a different color. The plant is also not unlike *Calligonum polygonoides* or *Periplocu hydaspidis*. It is common at Changa Manga in unirrigated places, Rawalpindi, Muzaffargarh. Flowers : February—March.

2. *EPHEDRA GERARDIANA*, Wall. *Cat.* (1828) No. 6048.—A

low rigid dense tufted shrub 6 inches to 4 feet high, stem woody, gnarled. Branchlets green, erect or arcuately ascending ; internodes .5-1.5 inches long, .05-.08 inch diameter, striate, smooth or slightly scabrid on the ridges ; leaf-sheaths .08 inch long, 2-toothed. Male spikes ovate, solitary or 2-3 together ; flowers 4-8, bracts rotund, obtuse, connate, .06-.08 inch long ; staminal column exserted, anthers 5-8. Female spikes usually solitary, 1-2-flowered ; tubillus exserted, straight. Fruit .3-.4 inch long, ovoid, red, sweet, edible. *E. vulgaris*, Hook. f. in *Fl. Brit. Ind.* V, p. 640.

Himalaya 8-14,000 feet. Common in the Upper Kagan Valley. Grows gregariously amongst stones and rocks. It is browsed by goats. Also in Pangi and Kunawar and on Shali, District Simla. Flowers : May—July. [The above plant includes *E. Gerardiana* var. *Wallichii* and var. *saxatilis* and *E. nebrodensis* var. *procera* of Dr. Stapf "Die Arten der Gattung Ephedra."]

3. *EPHEDRA INTERMEDIA*, Schrenk & Meyer, *Monog.*

Ephed. (1846) p. 88.—An erect shrub or prostrate below with long lax branchlets. Branchlets glaucous ; internodes usually

1-2 inches long; a few .5-.7 or occasionally 2-5 inches long, .06-.1 inch diameter, striate, scabrid on the ridges and rough to the touch when dry; leaf-sheaths .15 inch long or a little less, 2-toothed. Male spikes subglobose, numerous, in dense whorls at the nodes; flowers about 8, bracts broadly obovate, obtuse, connate, .06-.08 inch long; staminal column shortly exerted, anthers 5-6. Female spikes solitary paired or whorled, 2-flowered; tubillus exerted, twisted, long. Fruit .3 inch long, ovoid, red. *E. pachyclada*, Boiss.

Kunawar 6-9,000 feet, on rocks. Commoner than *E. Gerardiana* but has not been collected elsewhere in the Punjab. Trans-Indus. Flowers May.

XCVI. CONIFERÆ.

Trees or shrubs, usually resinous, mostly evergreen. Leaves usually needle-like or scale-like, rarely with a broad blade; stipules 0. Flowers monœcious or diœcious, perianth 0. Male flowers in deciduous catkins consisting of stamens which are usually scale-like and bear 2-6, rarely more, 1-celled pollen-sacs on the lower surface. Female flowers in cones, consisting of scale-like open carpels which are flat or peltate and bear either directly or on a special subsidiary scale (placental scale) 1-2-many ovules or the female cone reduced to a single ovuliferous scale or to a single ovule. Fruit usually a woody cone sometimes berry-like or formed from the ovule alone in which case the outer coat usually becomes fleshy. Embryo with 2-16 cotyledons. **DISTRIB.** A small family but as most of the species are gregarious, of great forest importance; throughout the world, chiefly in cold regions.

Resin-ducts in leaves and bark; female flowers in cones.

Cones woody.

Cones falling off entire.

Leaves needle-like.

Leaves in bundles of 3 or 5 ... 1. *Pinus*.

Leaves single ... 2. *Picea*.

Leaves scale-like ... 5. *Cupressus*.

Cones breaking up on ripening.

Leaves flattened, more or less distichous... 3. *Abies*.

Leaves triquetrous, fascioled on dwarf shoots, single and spirally arranged on long shoots ... 4. *Cedrus*.

Cones more or less succulent when ripe forming a berry-like fruit ... 6. *Juniperus*.

No resin-ducts in leaves or bark; female flowers consisting of a solitary ovule ... 7. *Taxus*.

1. *PINUS*, Linn. (*The Pines*.)

(The Latin name for the pine.)

Evergreen trees, the branches whorled. Shoots dimorphic, long-shoots and dwarf-shoots. Leaves dimorphic, those of seedlings and long-shoots single, needle-like or reduced to scales, those of the dwarf-shoots arranged in a bundle of 2, 3 or 5 on the shoots, their bases and the dwarf-shoot surrounded by scales (*bud-scales*), dwarf-shoots shed with their leaves. Flowers monœcious. Male catkins borne on the shoots of the current year, in whorls crowded at the base of the shoot, yellow, rarely purple. Stamens numerous, each bearing 2 pollen-sacs, the connective produced in a membranous tip. Female flowers in cones which are solitary or whorled, sometimes remaining at the tips of the shoots, at other times the shoot grows on and leaves the flowers at some distance below the tip; scales double the lower (*carpellary scale*) small disappearing in fruit, the upper (*placental scale*) bearing near its base 2 reversed ovules and becoming hard and woody in fruit. Cone formed from the imbricating woody or almost leathery placental scales. Seed usually with, rarely without a wing, cotyledons 4-15. **DISTRIB.** Species 70; Northern Hemisphere, temperate and mountainous subtropical regions.

Leaves in bundles of 3; cone of thick woody scales.

Leaves 9-12 inches long; bark thick, rough ... 1. *P. longifolia*.Leaves 2-4 inches long; bark thin smooth ... 2. *P. Gerardiana*.Leaves in bundles of 5; cone of slightly woody scales ... 3. *P. excelsa*.

1. *PINUS LONGIFOLIA*, *Roxb. Fl. Ind. III* (1832) p. 651.—A large tree, bark 1-2 inches thick, cut by deep fissures into irregular plates; branches whorled. Leaves in bundles of 3, 9-12 inches long, bright-green, each bundle surrounded at the base by a persistent sheath of bud-scales .5-1 inch long. Male catkins .5 inch long. Female cones on short stiff stalks, solitary or 2-5 together. Ripe cones 4-8 inches long, 3-5 inches diameter, scales very thick and woody with a pyramidal pointed or recurved beak. Seed .3 inch long with a long thin membranous wing. Cotyledons 10-14. Collett, *Fl. Siml.*, fig. 158. *The Chir Pine*. Vern. *chir, chil*.

From Afghanistan along the Himalaya and Siwalik Hills to Bhutan 1,500-8,000 feet. The best *chir* forests are found between 2,000 and 5,000 feet with a rainfall of 40-65 inches. It is found on all soils but requires perfect drainage consequently it avoids flat ground and does not grow as well on soils overlying limestone as on soils derived from sandstone, granite or metamorphic rock. The *chir* appears to require a monsoon rainfall as it does not extend into the inner valleys but stops abruptly at the furthest point to which the monsoon penetrates. This is apparently due to the seed falling in the hot weather and germinating as soon as the monsoon breaks. In its zone from 2,000-5,000 feet it usually forms practically pure forests but being strongly light-demanding the soil except under crops in the pole stage is covered with grass

and with shrubby undergrowth. The commonest species in the undergrowth are *Dodonaea viscosa* and *Carissa spinarum*. When the rainfall exceeds about 65 inches the *chir* forests are usually mixed with broad-leaved trees of many species and the undergrowth is as a rule very heavy. Such forests are difficult to regenerate and suffer greatly from fire. Of all the external dangers to which the *chir* is subject fire is by far the most serious but the tree is fortunately very resistant so that the fires do remarkably little damage except to seedlings and saplings unless there is a heavy undergrowth or a deep layer of needles on the ground. The *chir* sheds its needles in the hot weather just at the season when the forests are most liable to damage by fire and as the needles do not decay readily they accumulate from year to year and may form a layer almost a foot deep. With protection from fire the *chir* forests are usually easy to regenerate and regeneration is frequently all that can be desired even in forests open to heavy grazing. Above about 5,000 feet the *chir* is usually mixed with and gradually replaced by *Quercus incana* and *Pinus excelsa*. At the higher elevations it keeps to the ridges and warm slopes and usually stops at 7,000 feet in the outer hills and at lower levels in the inner hills. The bark is dark-grey with a reddish tinge especially in old trees and about 1-2 inches thick in the lower portion of the stem, it exfoliates in irregular plates. The sapwood is white and the heartwood pale reddish-brown. It is a rough coarse timber and not durable but being available in large quantity is much used. Apart from timber the *chir* is valuable for its resin, vern. *biroza*, *gandha biroza*, which is regularly extracted from it both in the Punjab and in the United Provinces. The *chir* is usually about 80 feet in height by 5-7 feet in girth but in places it reaches fully 100 feet in height and 8-12 feet in girth. I have measured one over 13 feet in girth. It is often grown in gardens in the plains but is not very easy to raise as the seedlings are apt to damp off. The needles of the *chir* are frequently attacked by a fungus *Peridermium complanatum*, Barclay, which appears as a pale-yellowish or bright-orange swelling on the needles. The damage done is insignificant but there is a form var. *corticola* which attacks the bark and this form is more serious (*vide* Butler, Ind. For. Vol. XXXI (1905) p. 614, fig. 8.) The *chir* flowers in March-April. The cones ripen in the cold weather but the seeds do not fall till May or June.

2. *PINUS GERARDIANA*, Wall. in Lamb. *Pin. ed.* 2, III (1837) p. 151.—A medium-sized tree, branches not or obscurely whorled; bark grey, thin, smooth, peeling off in large thin flakes, roughish on old trees near the base. Leaves in bundles of 3, 2-4 inches long, stiffish, dark-green, serrulate, sheath of bud-scales deciduous. Male catkins .3-.5 inch long. Female cones near the middle of the shoots. Ripe cones 6-9 by 4-5 inches, scales very thick and woody with a stout recurved beak. Seed 1 inch long, cylindric with a short caducous wing. Cotyledons 3-8. Vern. *Chilghoza* (Trans-Indus) *Neoza* (the seeds, but also loosely used for the tree) *Ri* (Kunawar) *Mirri* (Chamba).

Common in Afghanistan and Baluchistan. Local in the Punjab Himalaya and only found in the inner arid valleys. On the Sutlej in Kunawar between 6,000 and 10,000 feet, on the Upper Ravi in Chamba 8-8,500 feet also on the Upper Chenab. Not on the Jhelum or on the Kunhar (Kagan). Gregarious forming open forests often associated with deodar, also with *Quercus ilex* and *Praxinus xanthoxyloides*. Usually a small branchy tree 6-7 feet in girth and 50-60 feet in height occasionally up to 12 feet in girth. The wood is hard, tough and very resinous but is scarcely ever used. The main value of the tree lies in the seeds which are collected and eaten and are exported to the plains mainly from Trans-Indus. In the very dry forests in

Kunawar it is a most useful nurse for deodar and for this reason as well as for its edible seeds it should be tried in Kagan on hot dry slopes where deodar regeneration is difficult. *Pinus Gerardiana* is not found in any place with a monsoon rainfall. In Kunawar it begins a few miles up the valley from Wangtu, the last point reached by *Pinus longifolia*. Flowers: June-July. Cones ripen in the second year in September. They are heated to cause them to open and the seeds are shaken out and stored for winter food, being often eaten ground up and mixed with flour.

3. *PINUS EXCELSA*, Wall. *Pl. As. Rar.* III (1832) t. 201.—A tall tree, bark smooth slate-colored on young, rough with shallow fissures on old trees. Leaves in bundles of 5, 4-8 inches long, bluish or greyish-green, slender, drooping, sheath of bud-scales deciduous. Male catkins .3 inch long. Female cones at the ends of the shoots, usually 2-3 together. Ripe cones 6-12 inches long, cylindric, scales only slightly woody with obtuse tips. Seeds .3 inch long, wing three times the length of the seed. Cotyledons 8-12. Collett, *Fl. Siml.*, fig. 157. *Blue Pine*. Vern. *Biār* (Hazara, Rawalpindi), *Kail* (Kulu, Simla), *Līm* (Kunawar, Chamba).

From Trans-Indus along the Himalaya to Bhutan, 5,000-12,500 feet. The blue pine occurs both in pure and mixed forests. It has two zones which are fairly well marked, but it is by no means absent at intermediate elevations. It is a hardier tree than its common associates but being much more light demanding and not living so long as the deodar, spruce or silver fir, it is often driven out from the localities and elevations which are particularly suited to those species. The lower zone is somewhat below that of the deodar at about 5,000-6,000 feet but the abundance of the blue pine at this level is almost certainly due to fires which have recently been stopped. Both deodar and blue pine are sensitive to fire but the latter regenerates better in areas protected from fire: thus it has happened that in very many places since the forests have been protected the blue pine has extended downwards and now forms pure crops in the pole stage. In most cases the deodar has followed the pine so that the present pure blue pine crops are often only a phase in the re-establishing of the forest growth. The upper zone is at about 10,000-12,000 feet where on warm aspects or in exposed situations the blue pine predominates but is often mixed with silver fir. From 6,000-10,000 feet speaking generally, though exceptions are numerous, the blue pine is less abundant than its associates. The regeneration of the pine is excellent wherever the cover is sufficiently open and although it is apt to suppress the deodar owing to its more rapid growth the latter frequently benefits in its early years by the protection afforded by the pine. There are some peculiarities in the distribution of the blue pine in the outer hills which await an explanation. In the Murree Hills the blue pine is abundant but the deodar very scarce except at Birangali. Near Simla the deodar is more abundant than the blue pine and on the Dhaula Dhar in Kangra the blue pine does not occur at all. It is possible that the blue pine dislikes a heavy rainfall even more than the deodar. The timber of the blue pine is good, the sapwood white, the heartwood light-red. Of the common conifers it comes after deodar and for interior work such as planking and furniture it is preferable to deodar as it is not so oily. The resin yields a better quality of turpentine than chir resin but the blue pine forests are not so accessible and it has only been extracted experimentally hitherto. The blue pine has many enemies; the parasite *Arceuthobium minutissimum* has already been described (*vide* page 441). The most serious disease is caused by *Trametes pini*, Fr. a fungus which attacks and destroys the heartwood but does not kill the tree. It is supposed to be assisted in its spread by the lopping to which the blue pine is subjected in many places but probably

also spreads underground through the roots when the roots of a healthy tree are in contact with those of a diseased one. *Peridermium brevis*, Barclay, occurs on the needles in the form of pale yellowish or orange colored swellings but does little harm except in the variety *corticola* which attacks the bark. (*Vide* Bulter, Ind. For, XXXI, 1905, page 616, fig. 6.) The blue pine reaches 100 feet in height and 6-8 feet in girth, occasionally 150 feet by 12 feet. Flowers: April—June. The cones ripen September—November.

Several exotic pines have been tried in the Punjab mostly without success but there are specimens of the Cluster Pine, *Pinus Pinaster*, Soland. at Nachar, in Abbotabad and probably elsewhere. It is a 2-needled pine with stout needles 6-12 inches long. The growth at Nachar is very vigorous but the Cluster Pine suffers from snowbreak even in England so that it is unfortunate that it was not tried at a lower elevation. The timber is inferior to blue pine so that at Nachar where deodar grows to perfection this species would not be of value however well it might grow.

2. PICEA, Link. (The Spruces.)

(From the Latin *pice*, pitch; referring to the resinous juice. DISTRIB. Species 12; North Temperate and Arctic Regions.)

PICEA SMITHIANA, Boiss. *Fl. Orient.* V (1881) p. 700.—A large evergreen tree; branches whorled, horizontal, usually slightly curved, the branchlets hanging like tassels; bark rough out by shallow furrows into small plates. Leaves 1-1.5 inches long, spirally arranged all round the branches, needle-like, 4-sided, stiff, pungent. Flowers monœcious. Male catkins 1 inch long, solitary, erect, nearly sessile in the axils of the upper leaves, stamens with two linear pollen-sacs, the connective produced with a broad rounded denticulate apex. Female flowers in cones which are solitary, terminal, scales double the carpellary scale disappearing in fruit, the placental scale bearing near the base 2 reversed ovules. Cone formed from the imbricating coriaceous placental scales, 4-6 by 1-2 inches, pendulous, dark-brown when ripe. Seeds .2-.25 inch long, dark-grey or blackish, wing obliquely spatulate, .5 inch long. Cotyledons 5-8. *P. Morinda*, Link. *Fl. Brit. Ind.* V, p. 653. Collett, *Fl. Siml.*, fig. 160. *Himalayan Spruce*. Vern. *Kachal* (Kagan), *Rai* (Kulu), *Tos* (Chamba), *Raiang* (Kunawar).

Afghanistan and Himalaya as far east as Kumaon, 6,000 to 11,000 feet. Rarely pure, usually associated with silver fir, deodar, blue pine or broad-leaved trees. The sylvicultural requirements of this tree are similar to those of the silver fir but it does not stand heavy shade so well as that species and prefers somewhat warmer and dryer situations. The regeneration is usually good in mixed forests of deodar and blue pine but in such places being much inferior to these trees it has to be discouraged. In forests of spruce and silver fir regeneration is frequently difficult to obtain. Although commonly found growing with the silver fir there are many exceptions. In the Murree Hills where the silver fir is common the spruce is very scarce only occurring near Mochpuri. On the Dhaulā Dhar I have not seen the two growing together, near Dharmasala the silver fir is found but no spruce, whereas further east above Palampur the spruce occurs but no fir. This separation of the firs is certainly not due to elevation nor can it be explained by a difference of rainfall. The wood of the spruce is white, soft and even-grained, there is sometimes a brown tinge in the centre of old trees but there is no heartwood. This brown timber is said by

contractors not to float but experiments in floating sawn specimens in a tank made by the Divisional Forest Officer, Chakrata, and by myself showed that the brown timber floats as well as the white. Such experiments in still water are inconclusive and as the fir forests are gradually becoming valuable it would be useful to ascertain whether the belief is founded on fact. The shoots and needles of the spruce are sometimes attacked by a fungus which occurs in two forms both believed to be stages of the same fungus. The acedial stage (*Peridermium Thomsoni*, Barclay) causes the needles to assume a yellowish color and they do not spread stiffly from the stem (*vide* Butler, Ind. For., volume XXXI (1905), page 611). The teleuto stage (*Barclayella deformans*, Dict.) causes a greater deformity of the shoot and the needles are orange-red in color (*vide* Butler, l. c. p. 613, fig. 6). The needles are also attacked by *Peridermium piceæ*, Barclay, which causes orange-yellow swellings (*vide* Butler, l. c. p. 614, fig. 7). The spruce frequently reaches 150 feet by 10 feet girth and 215 feet by 23 feet has been measured. Flowers: April. Cones ripen in October—November.

3. *ABIES*, Juss. (The *Silver Firs*.)

(The Latin name for some species of fir.)

Tall evergreen trees. Leaves more or less distichous, needle-like, usually flattened. Cones erect, scales thin, breaking away from a persistent woody axis when ripe, the carpellary scales smaller than the placental but occasionally longer and projecting between them; placental scales bearing at the base, 2 reversed ovules. **DISTRIB.** Species 20; North temperate and Arctic regions.

Shoots quite glabrous; leaves 1-2 inches long,
distichous

Shoots clothed with short brown hairs; leaves 5-

1 inch long, spreading in all directions except
below

1. *A. Pindrow*.

2. *A. Webbiana*.

1. *ABIES PINDROW*, *Spach. Hist. Phaner.* XI (1842) p. 423.—A large evergreen tree with a narrow cylindric crown of very dark foliage, branches whorled, bark smooth on young stems, dark-grey rough with deep vertical furrows on old stems; branchlets quite glabrous. Leaves very variable, 1-2 inches long, distichous, needle-like, flattened, lower surface with two pale glaucous bands (of stomata) on either side of the raised midrib, the tip notched. Flowers monœcious. Male catkins, .5-.7 inch long, clustered; stamens with 2 linear pollen-sacs, connective produced in a thickish upturned obtuse appendage. Female flowers in cones which are solitary or in distant pairs, erect, situated a little below the tips of the shoots, dark-purple; scales double the carpellary in flower, longer than the placental. Cone erect, cylindric, 4-7 by 1.5-3 inches, formed of the placental scales which are imbricate crustaceous and more than twice as long as the carpellary scales. Seed .4-.5 inch long, brown, shining, wing longer than the seed. Collett, Fl. Siml., fig. 161. *Low-level silver fir*. Vern. *Réwar* (Kagan), *Paludar* (Murree Hills), *Rai* (Chamba), *Tos* (Kulu), *Span, krok* (Kunawar).

Himalaya, Afghanistan to Nepal, 7,000-10,000 feet, occasionally scattered specimens are found in ravines at 6,000 feet. Usually associated with spruce, deodar and blue pine but occasionally other conifers except the yew and sometimes the blue pine are absent and it is found with broad-leaved trees, the fir occupying the ridges with *Quercus dilatata* and *semecarpifolia*, the moister ravines being usually occupied by deciduous broad-leaved trees such as maples, elm, horsechestnut and bird-cherry. The pure silver fir forests although they do not occupy nearly as large an area as the mixed fir and spruce forests are more accessible and have consequently been more worked. They are found in the Murree Hills and on the Dhaulā Dhar in Kangra and in them regeneration is most unsatisfactory. Young fir is often found coming up in the forests of the Murree Hills but it occurs in areas not at present occupied by fir. Regeneration is often good under blue pine and large patches of shrubs, especially *Viburnum nervosum*, frequently shelter young silver fir in sufficient numbers to form eventually fully stocked groups. But in forests at present fairly well stocked with mature fir regeneration is usually almost or completely wanting. The same thing has been found in the Jaunsar in the case of silver fir and spruce mixed. Mr. P. H. Clutterbuck in the Jaunsar-Bawar Working Plan remarks: "It is observable throughout Jaunsar that all good natural reproduction of firs that can be found is either in mixed forest or on ground which has been lying fallow as far as firs are concerned, for many years." His conclusions are that the deep humus of the fir forests keeps the soil too wet for fir seedlings and with this I am in entire agreement. Near Changlagali where silver fir regeneration is particularly bad I have seen what appeared to be an abandoned silver fir nursery but which on examination proved to be a site which had been cleared for some building and had been sown up naturally. The fir forests are yearly becoming more valuable and the problem of regenerating them on a large scale will soon have to be solved. The timber of the silver fir is very similar to that of the spruce but on the whole is not quite so good and large trees are usually hollow. A height of 206 feet and a girth of 26 feet has been measured. Flowers: April. Cones ripen in September and break up shedding the seed in October—November.

2. *ABIES WEBBIANA*, Lindl. in *Penny Cyclop.* I. (1833) p. 30.—A tree much resembling *A. Pindrow* but usually more stunted and gnarled. Leaves 5-1 inch long, spreading in all directions and densely covering the twigs when viewed from above, more or less distichous when the twigs are seen from below, young shoots clothed with short brown hairs. Cones shorter and thicker than in *A. Pindrow*. *High-level silver fir*. Vern. as for *A. Pindrow*.

Himalaya 11,000-13,000 feet. Occurs in Kagan at Safr Maluk; in Simla on the Chor; Bashahr, Harangati, &c. The Himalayan silver firs have all been referred to one species and there is room for considerable difference of opinion as to whether there are one, two or three species. Professor H. Mayr (Wald- und Park-baueme fuer Europa) shows that the Eastern Himalayan fir is different from the Western. The Eastern species *A. densa*, Griff. has the hairy shoots and short cone of *A. Webbiana*, but the leaves are rather longer. In the ripe cone the carpellary scales are spatulate with a cuspidate point and nearly equal the placental scales in length, the tips being visible between the latter before the cone breaks up. The cones of *A. Webbiana* resemble those of *A. Pindrow* in the relative lengths of the carpellary and placental scales. As regards the two Western firs the fact that they both come true to seed when grown in England and that specimens are readily separable by the young shoots is in favor of keeping them distinct. On the other hand all the forest officers with experience of the firs I have consulted were of opinion that there was only one species which differed in appearance according to elevation. The two species appear to have

the same habit and general appearance and the timber is probably not distinguishable. The exact distribution of the two firs is a matter for investigation in the field.

4. CEDRUS, Loud. (*The Cedars*.)

(The Latin name for one species. Species 3; one *C. atlantica*, Manetti, in the Atlas Mountains, one *C. Libani*, Barr., in the mountains of Asia Minor and Cyprus, and the following.)

CEDRUS DEODARA, Loudon, *Arb. Brit.* IV 2428, f. 2283-2286 (1838).—A large evergreen tree; branches not whorled, the leading shoot and tips of the branches usually drooping; bark dark, sometimes almost black, usually very rough on old stems, sometimes only slightly furrowed. Shoots dimorphic, long-shoots with the needles solitary and arranged spirally and dwarf-shoots with the needles arranged in dense whorls. Leaves 1-1.5 inches long, needle-like, triquetrous, sharp-pointed. Flowers usually monœcious, but some trees or branches habitually bear flowers of one sex. Male catkins solitary at the ends of the branchlets, cylindric, 1.7 inches long; stamens with 2 oblong pollen-sacs, the connective produced as a flattened, ovate, obtuse, up-turned appendage with an irregularly crenulate margin. Female flowers in cones which are solitary at the ends of the branchlets; scales double, the placental scale large the carpellary small, the placental scale bearing near the base 2 reserved ovules. Cone erect, 4-5 by 3-4 inches, formed of the imbricating, thin, woody, placental scales which break away when ripe leaving a stout woody axis. Seed .3-.6 inch long, pale-brown, wing longer than the seed. *C. Libani*, Barr. var. *Deodara*. Fl. Brit. Ind. V, p. 653. *Deodar*. Vern. *paludar* (Kagan), *diâr*, *keclu* (Punjab Himal.), *kelmung* (Kunawar).

Trans-Indus and Himalaya as far east as the Alaknanda, 4,000-10,000 feet, but most frequent at 6,000-9,000 feet. The deodar is not infrequently found growing pure, but it is more often mixed with blue pine, spruce and silver fir and occasionally with *Quercus incana* and *dilatata*. On the first high ranges of the Himalaya facing the plains the deodar is not common, except near Simla. On the Dhaula Dhar in Kangra it is only found at one place on precipitous rocks. In the Murree Hills the deodar is found sparingly on rocky ground, except for a patch at Birangali. The explanation is apparently that the deodar dislikes a heavy rainfall. In moist forests it is usually confined to the ridges and steep rocky ground, the gentler slopes and ravines being stocked with spruce and silver fir or deciduous broad leaved trees. It extends well into the dry inner valleys of Kagan, Pangi and Kunawar, but in these dry parts the tree is stunted and a large proportion of the bigger stems is hollow. As regards its sylvicultural requirements, good drainage is essential, and provided this is secured, deodar will grow in all soils. It will stand a certain amount of shade, more than the blue pine but less than spruce, and on warm aspects and at low elevations the shelter of blue pine is beneficial to young deodar, but unless assistance is given, the blue pine is apt to suppress the deodar. In the upper portion of its zone at about 9-10,000 feet the deodar forests have been invaded by fir and it is common to find large deodar trees at this elevation surrounded by a dense growth of fir, the latter being considerably younger than the fir. This I believe to be largely the

result of fire protection, since most of the deodar in these places still show signs of damage by fire, especially near their base on the up-hill side, but no trace is seen on the fir. To obtain and maintain deodar reproduction in such places is impracticable until the fir forests can be worked intensely, and as the deodar trees which die or are felled are not being replaced by deodar, the deodar bearing area is being reduced. On the other hand, and also owing to fire protection, the deodar is extending downwards in many places, usually following blue pine, and these places being accessible for export, will probably more than compensate for the areas lost to the fir. Generally speaking, in the lower portion of its zone deodar reproduction is satisfactory, but there are exceptions. In some forests, especially those at present pure or nearly pure deodar, reproduction is very scanty and the best method of obtaining it has not yet been ascertained. The timber of the deodar is better than that of the other conifers and is very durable. The heartwood is usually not eaten by white ants, but the sapwood is readily attacked. The principal use is for railway sleepers which last about 12 years on the average. From the wood an oil is extracted by destructive distillation. It is used for water-proofing and preserving the inflated skins used on the main Punjab rivers. The deodar reaches a very great age and a large size, trees 25 feet in girth are not uncommon, and Stewart notes one in Chamba 44 feet in girth at 2 feet from the ground. Heights from 200-250 feet have been recorded, but it is not clear whether a tree of 250 feet has ever been accurately measured. I have measured a fallen tree in Kagan 195 feet to the top which had been broken off at a diameter of 6 inches. Young deodar plants have been known to be killed by *Fomes annosus*, Fr. (*Trametes radiciperda*, Hartig), but the fungus does not appear to be at all common. A more serious disease is caused by *Peridermium cedri*, Barclay. This fungus attacks the needles which become pale in color and scanty, many of the needles being deformed. If these deformed needles are examined about May, they are seen to be covered with yellow flecks. Young trees are sometimes killed by this disease. (*Vide* Troup, Ind. For. Vol. XL (1914), p. 469, plate 14, and Vol. XXXVIII (1912), p. 222, plate 3). Flowers : October. Cones ripen October—November of the following year.

5. CUPRESSUS, Linn. (The *Cypresses*.)

(The Latin name for the Cypress.)

Evergreen trees, branches whorled or not. Leaves ; of seedlings and young plants needle-like, in whorls of 3 or 4, spreading ; of older plant scale-like, densely covering the shoots, the tips spreading or closely adpressed, opposite in pairs. Flowers monœcious. Male catkins numerous, solitary at the tips of the branchlets, ovoid, small ; stamens stipitate, peltate, bearing on their lower edge 2-6 globose pollen-sacs. Female flowers in cones composed of 4-12 decussate, peltate scales, those at the base and apex sterile, the others bearing above the base 2 to many upright ovules. Cone globose, woody, composed of the peltate scales which touch one another at the edges, but do not overlap, taking one or two years to mature. Seeds compressed or angular with lateral wings. Embryo with 2-4 cotyledons. **DISTRIB.** Species 16 in 2 sections often considered genera ; about half have been introduced and two species are frequently grown ; Mediterranean region, Asia and North America.

- | | | | |
|--|-----|-----|-----------------------------|
| Branches spreading, branchlets drooping; cones about .5 inch diameter | ... | ... | 1. <i>C. torulosa</i> . |
| Branches fastigiate, branchlets very slender; cones about 1 inch diameter | ... | ... | 2. <i>C. sempervirens</i> . |
| Branches spreading; branchlets bright-green, pendulous, spreading fan-wise; cones about .4 inch diameter | ... | ... | 3. <i>C. funebris</i> . |

1. *CUPRESSUS TORULOSA*, *D. Don, Prodr. Fl. Nep.* (1825) p. 55.—A large tree, bark peeling off in long thin strips, branches horizontal, more or less whorled, branchlets drooping, varying considerably in color, usually deep green. Leaves with closely adpressed tips so that the branchlets are not rough to the touch. Male catkins .2 inch long, tinged with purple (? always). Ripe cones clustered, about 1 inch diameter. *Himalayan Cypress*. Vern. *Devidiār* (Chamba, Kulu), *deodar* (Kulu, Simla).

Himalaya 6,000-9,000 feet from Chamba eastwards. Found locally in Chamba, Kulu and Simla. Usually on warm dry slopes with shallow or rocky soil. This tree is remarkable for the wide variations of climate it will endure; in spite of occurring naturally at considerable elevations in the hills it grows very well in the plains and there are several large specimens in Lahore. In the Punjab this tree has not received the attention it deserves, but it is appreciated in South Africa and considerable quantities of seed have been sent to the South African Forest Department. In Darjeeling where the rainfall is about the same as in Dharmasala it has done better than deodar, and it is well worth trying instead of deodar or mixed with it, in localities in which deodar does not occur naturally, but has been planted on a fairly large scale, such as Dharmasala and Murree. It would also perhaps give better results on hot dry slopes with poor soil where deodar is difficult to grow, such as the Simla Water Supply Catchment Area. The growth of trees found growing naturally is slow, but this may be attributed to poor soil, as when cultivated the growth is fast. The tree reaches a large size; Stewart records one of 27 feet girth near the ground, but this is exceptional. The sapwood is white, the heartwood tinged with yellow, red or brown, fragrant. It is very durable perhaps even more so than deodar, and in the United Provinces is cut for sleepers which are not usually distinguished from deodar and when sold as Cypress realize almost the same price as deodar. The cones take two years to mature, the seed ripening in October—November.

2. *CUPRESSUS SEMPERVIRENS*, *Linn. Sp. Pl.* (1753) p. 1002.—A tall tree with a narrow pyramidal crown, stem fluted, bark with shallow vertical fissures, branches ascending not whorled, branchlets deep-green very slender. Leaves with closely adpressed tips, so that the branchlets are not rough to the touch. Male catkins .1 inch long. Ripe cones solitary or few together, about 1 inch diameter. *Pyramidal Cypress*. Vern. *saru*.

Cultivated in the plains, especially in old gardens, such as those round Delhi. Also in graveyards. The tree described is a variety which is only known in the cultivated state. The wild form with spreading branches is indigenous to Asia Minor. There are many garden varieties some with spreading branches which have recently been introduced. The cones take 2 years to mature.

3. *CUPRESSUS FUNEBRIS*, Endl. *Synop. Conif.* (1847) p. 58.—A medium-sized tree with wide-spreading curved branches, bark dark with shallow vertical fissures, branchlets bright-green, pendulous, spreading in the same plane. Leaves not closely adpressed at the tips, so that the branchlets are rough when rubbed upwards. Male catkins .1 inch long. Ripe cones about .4 inch diameter. *Weeping Cypress*.

Indigenous to China. Commonly cultivated in gardens and graveyards in the plains. The cones take 2 years to mature.

Amongst others the following species have been introduced; both belong to the section *Eucupressus*, having more than 2 ovules to each cone-scale and taking 2 years to mature the cones.

CUPRESSUS LUSITANICA, Mill.—Foliage glaucous. Branchlets rough when rubbed upwards; leaves not closely adpressed each with a large well-marked gland near the base. *C. glauca*, Lamk. *Goa Cypress*.

Native country not known. Cultivated in Lahore.

CUPRESSUS MACROCARPA, Gord.—A tree much resembling *C. sempervirens* and more easily distinguished in the field than from specimens. The fruits are more clustered and often larger, darker reddish-brown; the branchlets are not so slender and spread fanwise from the principal axes. *Monterey Cypress*.

Indigenous to California. Cultivated in Abbottabad. The growth is very fast.

6. *JUNIPERUS*, Linn. (*The Junipers*.)

(The classical name used by Pliny and Virgil.)

Low evergreen shrubs or trees, aromatic. Leaves often glandular on the back, needle-like in whorls of 3; or scale-like, opposite, in pairs or threes, on young plants and vigorous shoots, subulate, spreading. Flowers monœcious or diœcious. Male catkins small, cylindric, ovoid, axillary or terminal, solitary; stamens decussate or in threes, connective enlarged ovate or peltate at the apex, bearing 2-6 globose pollen-sacs near the base. Female flowers in cones composed of 2-6 opposite or ternate scales, the scale usually not all fertile; ovules 1-2 to each fertile scale, upright. Fruit a berry-like cone, more or less succulent, smooth or marked by the tips of the scales. Seeds 1-12, hard, bony, not winged. Embryo with 2-6 cotyledons. *DISTRIB.* Species 30-40; North Temperate and Arctic regions.

Leaves needle-like in threes; flowers diœcious
axillary, female flowers with only the upper
whorl of scales fertile; ovules 1 per scale,
cone globose ... 1. *J. communis*.

Leaves scale-like or subulate and pungent;
flowers diœcious or monœcious, terminal;
female flowers with 2-3 whorls of scales, of
which the upper whorl is sterile; ovules 2
or 1 per scale.

Leaves pungent in threes; cone 1-seeded, ovoid 2. *J. recurva*.

Leaves mostly scale-like, decussate.

A small or medium-sized tree; cone 2-5-seeded, globose ... 3. *J. macropoda*.

A shrub; cone 1-seeded, ovoid ... 4. *J. pseudo-sabina*.

1. *JUNIPERUS COMMUNIS*, Linn. *Sp. Pl.* (1753) p. 1040.—A dense shrub more or less procumbent. Leaves .2-5 inch long, in whorls of 3, linear, sharply pointed, spreading nearly at right-angles from the branchlets, convex on the back, concave and glaucous bluish-white on the upper surface, jointed at the base and continued down the stem with a large gland on the decurrent portion. Flowers dicecious, axillary. Fruit .3-4 inch long, subglobose, blue-black, glaucous, the tips of the scales visible at the apex. Seeds 1-3. Vern. *bhentri* (Haz.), *tailu* (Bash.).

Himalaya 9,000-14,000 feet from Kumaon westwards. Common in the inner hills of Kunawar, Chamba and Kagan. Sometimes found in the undergrowth of dry deodar forests, but more usually on rocky ground towards the limit of plant growth. Gregarious, either pure or with other members of the genus, forming dense patches; the branches pressed down by snow. The fruit is used medicinally as an emmenagogue. Flowers: April—May. Fruit ripens in October of the second year.

2. *JUNIPERUS RECURVA*, Buch.-Ham. in D. Don, *Prodr. Fl. Nep.* (1825) p. 55.—A procumbent shrub. Leaves .1-2 inch long, in whorls of 3, lanceolate, sharply pointed, ascending, loosely imbricated, somewhat incurved, back convex, upper surface concave, base not jointed, decurrent with a large gland on the decurrent portion which is often produced along the back of the free portion, looking like a mid-rib in dry specimens. Flowers dicecious, terminal or terminating short lateral branchlets. Fruits .3-4 inch long, ovoid, dark-brown or blackish-purple, shining when ripe. Seed one.

Himalaya 8,000-14,000 feet. Common usually associated with *J. communis* above the forest limit on rocky ground, the less rocky places being occupied by turf. Forms dense thickets about waist high, the branches pressed down by snow, and running along the ground. This the commonest species of Juniper in the West Himalaya is var. *squamata*, Parlat. Probably quite a different species to the type which is a small tree found in Bhutan and Sikkim. Some specimens resemble small-leaved specimens of *J. communis* and are very likely hybrids. Flowers: June—July. Fruit ripens: July—October of the second year.

3. *JUNIPERUS MACROPODA*, Boiss. *Fl. Orient.* V (1881) p. 709.—A small or medium-sized tree; bark reddish-brown, fibrous, vertically fissured, exfoliating in fibrous strips. Leaves of two kinds; on young seedlings and some of the lower branches subulate, pungent; on most branches scale-like, closely adpressed, with a large oblong or elliptic gland in the centre of the back. Flowers monœcious, the male at the tips of the

branchlets, the female terminating short side branchlets. Fruit .3 inch diameter globose, blue-black, very resinous, the tips of the scales forming transverse ridges. Seeds 2-5. *Himalayan Pencil Cedar*. Vern. *shupa, shur*.

Inner dry Himalaya 9,000-14,000 feet. At the head of the Kagan Valley and on the Upper Chenab, Beas and Sutlej. Gregarious, forming open forests on rocky ground. Not usually over 6-7 feet in girth, but Stewart notes one in Lahoul of 33½ feet girth. The tree is much like *Cupressus torulosa* in foliage, but the branchlets are shorter, more spreading and not pendulous, and the fruits are quite different. The wood is moderately hard and fragrant. It is used locally for building and for fuel, but as a wood for pencil-making in the Punjab it is not sufficiently common and far too inaccessible to be of any value. Flowers: May. Fruit ripens in October.

4. *JUNIPERUS PSEUDO-SABINA*, Fisch. and Mey. *Ind. Sem. Hort. Petrop.* VIII *Animad.* (1842) p. 65.—A shrub. Leaves of two kinds; on young seedlings vigorous long shoots and some of the lower branches flattened, more or less spreading, with sharp tips; on most branches scale-like closely adpressed, the backs obtusely keeled, so that the branchlets are more or less quadrangular; gland narrow-linear, not very conspicuous. Flowers dioecious, terminating short or very short lateral branchlets. Fruit .3 inch long, ovoid, blue when ripe. Seed 1. — *J. Wallichiana*, Hook. f. and Thoms.

Inner dry Himalaya 10,000-14,000 feet. Chamba and Kunawar. Apparently not found in Hazara or on the outer ranges. Apart from its smaller size it may be distinguished from *J. macropoda* by its denser tetragonal branchlets and ovoid 1-seeded fruits. Grows in dense patches on rocky ground above the forest limit. Flowers: May. Fruit ripens: July—September.

JUNIPERUS CHINENSIS, Linn.—A small tree with a compact pyramidal crown. Foliage dimorphous, linear, pungent, .3 inch long or scale-like and imbricate, often with the tips of the shoots here and there yellowish or silvery-white. Flowers dioecious. Fruit small, brownish-violet.

Indigenous to China. Occasionally grown in gardens in the plains.

7. *TAXUS*, Linn.

(The classical name of the Yew. *DISTRIB.* Species 1 in the North Temperate Zone.)

TAXUS BACCATA, Linn. *Sp. Pl.* (1753) p. 1040.—A small or medium-sized evergreen tree, stem fluted; branches horizontal, wide-spreading, not whorled. Leaves 1-1.5 inches long, linear, flattened, distichous, acute, narrowed into a short petiole which is decurrent along the twig, dark-green and shining above, pale yellowish-brown or rusty-red below. Flowers usually dioecious. Male flowers in catkins which are subglobose and solitary in the leaf-axils; stamens about 10, pollen sacs 5-9, globose, arranged around the filament beneath the peltate tip of the stamen. Female flowers solitary, axillary, resembling leaf-buds, each consisting of a few imbricate scales round a single erect ovule, which is surrounded at the base by a

membranous cup-shaped disk. In fruit the disk enlarges, becomes succulent and bright-red, about $\frac{1}{3}$ inch long, and surrounds the olive-green seed of which only the tip is exposed. Testa woody; embryo with 6-7 cotyledons. *Yew*. Vern. *barmi, rakhal, thuna, ekaling* (Kun.).

Himalaya 6,000-10,000 feet. In dense shady forests often forming an undergrowth to silver fir. Not uncommon. The usual size is 5-6 feet girth and 20 feet in height. The statement that the yew reaches 100 feet in height in the Himalaya is probably due to a mistake. I have never seen any approaching that size. The growth is very slow, 20-30 rings per inch radius. The tree takes up a lot of room, so that it is sometimes necessary to fell it in regeneration areas if it happens to be common. The wood is smooth, hard, close- and even-grained and durable. The heartwood is reddish-brown and there is a small demand for it for inlaying work and similar ornamental purposes, but the trees are very irregular in shape and knotty, so that even the largest yield little useful wood. The wood is universally esteemed for bows. The yew will stand more shade than almost any other tree and only reproduces in dense shady moist forests. The twigs are much lopped in Hazara for use as litter. Flowers: April—May. Fruit ripens in November of the same year.

The following species not belonging to indigenous genera have been introduced:—

CALLITRIS QUADRIVALVIS, *Vent.*—A small tree with the habit of *Cupressus*, reaching 20 feet high. Twigs slender. Leaves scale-like, in whorls of 4, composed of an inner compressed and an outer pair, not crowded. Cones $\frac{1}{5}$ inch long, composed of 4 scales, the inner pair with very concave backs, all valvate.

A tree of the Atlas Mountains. Yields the sandarac resin which is used medicinally and for varnish. There is a good specimen in the Anarkali Gardens, Lahore.

THUYA ORIENTALIS, *Linn.*—A small tree with the habit of *Cupressus*, reaching 20 feet high. Twigs spreading mainly in the vertical plane. Leaves scale-like, in opposite pairs, densely crowded. Cones $\frac{1}{7}$ inch long, ovoid, composed of 6 imbricate scales of which the uppermost pair is sterile and often united into a columella.

Indigenous to China and Japan. Has long been introduced in India and is perhaps the commonest conifer cultivated.

CRYPTOMERIA JAPONICA, *D. Don.*—An evergreen tree reaching 120 feet in height, with a narrow conical crown. Leaves falcate-subulate, ascending, pointed in all directions, the free portion up to $\frac{1}{5}$ inch long, shorter at both ends of the season's growth; the bases decurrent, ridged on the back. Cones $\frac{1}{6}$ - $\frac{1}{2}$ inches long, broadly ovoid somewhat burr-like from the pectinate tips of the scales.

Indigenous to Japan and China. There are a few trees growing well in Simla. This tree may be recommended for planting in place of deodar in places with a heavy rainfall, such as Dharmasala. It has been very successful in plantations near Darjeeling at 4-6,000 feet. The growth is fast.

GINKGO BILOBA, *Linn.*—A large deciduous tree. Leaves fan-shaped, base cuneate, entire, apex irregularly wavy or lobulate, sometimes 2-lobed; petiole 1-3 inches long. Flowers dioecious. Male catkins without scales, the stamens consisting of 2 pollen sacs on the top of a stipe. Female flowers stalked, consisting usually of 2 ovules on a rudimentary carpellary-scale. Seed 1-1 $\frac{1}{2}$ inches long, with a thick resinous pulpy outer layer. *Maiden-hair tree*.

Indigenous to China. Cultivated occasionally in gardens, Lahore, Abbottabad. Does well in the hills at 6,000 feet.

CUNNINGHAMIA SINENSIS, R. Br.—A medium-sized tree, 30-40 feet high, branches whorled. Leaves linear, acute, rigid, sharply-pointed, about 1·5 inches long by ·15 inch wide, distichous, margins obscurely serrulate. Cones 1·2-1·5 inches long, scales cordate-triangular, coriaceous, imbricate.

Indigenous to China and Cochin-China. Does well in Abbottabad, but is a rather scraggy tree. The stem is usually surrounded by suckers which may be dug up and used for propagation. Flowers: March.

ARAUCARIA CUNNINGHAMII, Sweet.—A large tree reaching 150-200 feet in height and 18 feet in girth, branches in whorls. Leaves much like those of *Cryptomeria japonica*. Male catkins 2-3 inches long, ·3 inch diameter. Cones 3 inches long, 2 inches diameter; the scales broadly cuneate, the apex flattened, bearing a rigid spreading or recurved point. *Richmond River Pine*.

Indigenous to New South Wales and Queensland. Cultivated in Lahore. This tree may be distinguished from *Cryptomeria* by its branches in whorl and the bark peeling off horizontally; in *Cryptomeria* the bark peels vertically.

XCVII. CYCADACEÆ.

Small trees with the appearance of palms from which they may at once be distinguished by the involute veneration, Leaves pinnate, large. Flowers dioecious. Male flowers in erect cones formed of thick stamens which bear on the lower surface numerous globose anther-cells. Female flowers in a large cone resembling the leaf-bud and composed of imperfectly developed leaves (*carpophylls*) which bear on the edge towards the base 1-4 pairs of large ovules. Cotyledons 2. **DISTRIB.** A small family; tropical and sub-tropical. There are no indigenous representatives, but the following are grown in gardens.

CYCAS, Linn.—*Carpophylls* with 4-8, rarely 2 ovules, which are erect or horizontal. Stem growing through the female cone.

CYCAS REVOLUTA, Thunb.—Trunk 6 feet high producing suckers freely. 12 inches or more in diameter, densely clothed with the old leaf-bases. Leaves 2-6 feet long; leaflets about 3-6 inches long, 2 inch wide, the margins strongly recurved. *Carpophylls* 4-9 inches long, the blade pectinate; ovules 4-6.

Indigenous to Japan and China. Commonly grown in gardens in the plains. The female plant only has been introduced and is propagated by suckers.

CYCAS CIRGINALIS, Linn.—Trunk 15 feet high, 6-12 inches diameter. Leaves 5-9 feet long; leaflets 6-12 by 3·5 inch. Male cone ovoid-oblong, 8 inches long, 3 inches thick, tip of the stamens with a long upturned acuminate point. *Carpophylls* 6-12 inches long, the blade lanceolate, tapering to a long point, crenate or spinous-toothed.

Indigenous to S. India, Malaya, etc. Cultivated occasionally in the plains. Both sexes are in cultivation.

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